A Scranton Gillette Publication

MARCH 1961

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

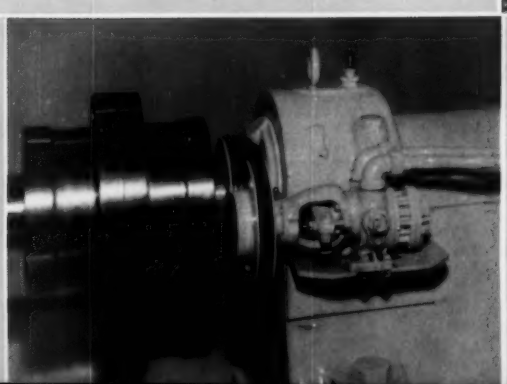
UNIVERSITY MICROFILMS
313 N. 1ST ST.
ANN ARBOR, MICH.
COMP

SAN DIEGO'S $534,000 LIME RECALCINING PLANT

p 81

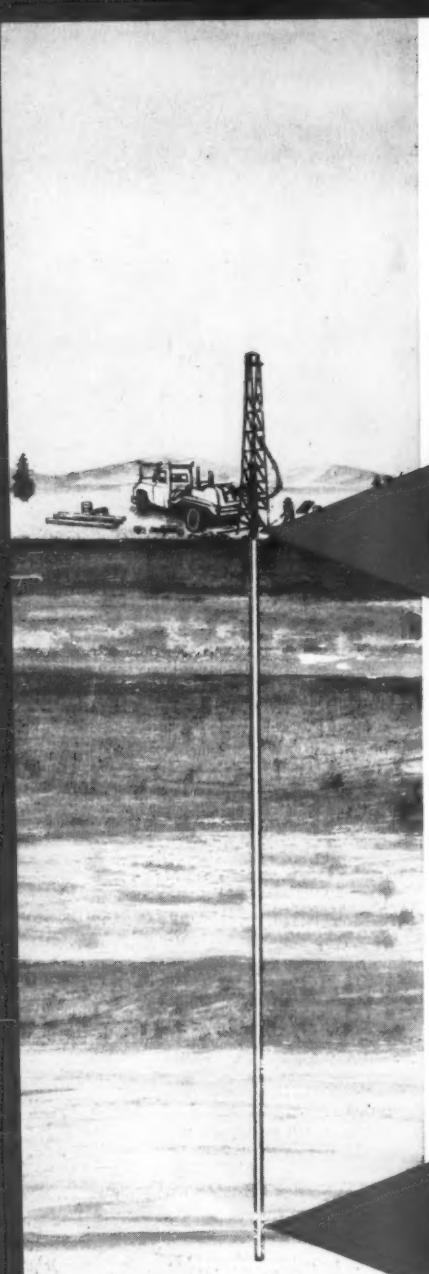
A UNIVERSAL PROBLEM IN SLUDGE DIGESTER OPERATION

p 85



GEAR PUMP USED TO PUMP OIL TO WEARING RINGS IN BROOKLYN SEWAGE PUMPING STATION

p 113



Layne
SINCE 1882

Layne Vertical Turbine Pumps are designed, engineered and manufactured by Layne in Memphis, Tennessee and nowhere else. Because pumping needs vary, there is a Layne pump for every pumping requirement—from 30 to 100,000 G.P.M. in sizes from 4 to 42 inches. Layne Pumps include Deep Well and Short Coupled (oil or water lubricated), Propeller, Mixed Flow, Regular and "In-Line" Submersible. For additional information write for bulletins 200-oil lubricated or 201-water lubricated.

has the only complete service that means

Water

The Layne Gravel Wall Well is an example of Layne experience, engineering and research. This gravel packing and 134 shutter screen employment affords larger screen openings, reduced friction, reduced draw down and pumping head. It increases specific capacity and makes for more effective retention of native sands. For additional information write for bulletin 900.

From top to bottom, you can depend on Layne for the most complete water service in the industry. This complete service provides undivided responsibility for the delivery of water . . . of the quality and in the quantity required. Over 75 years of *growing* service gives the skill and technical know-how which makes Layne First in the field of water. For additional information write for bulletin 10.

LAYNE
OFFERS COMPLETE
WATER SERVICE:

Initial Surveys • explorations • recommendations • site selection • foundation and soil-sampling • well drilling • well casing and screen • pump design, manufacture and installation • construction of water systems • maintenance and service • chemical treatment of water wells • water treatment—all backed by Layne Research.

Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.

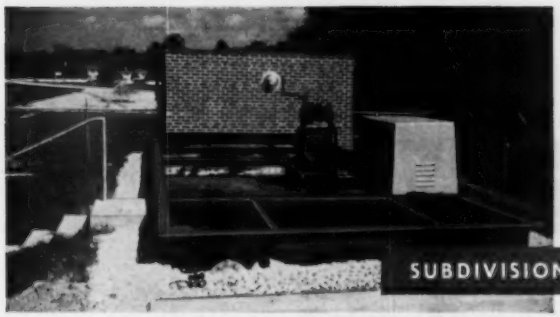
Layne SINCE 1882 — COMPLETE WATER SERVICE

LAYNE & BOWLER, INC., MEMPHIS

General Offices and Factory, Memphis 8, Tenn.

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

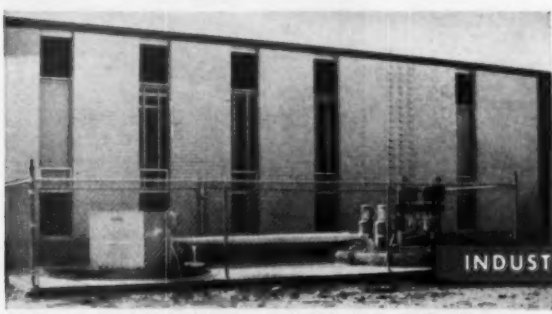
SALES REPRESENTATIVES IN MAJOR CITIES



RAMS . . . Indianapolis, Indiana . . . RatedAeration, medium steel sewage treatment plant for design flows to 15,000 GPD. Factory fabricated with "Chicago" standardized balanced equipment. Engineer—Bevington, Taggart & Fowler. Bulletin 135-A.

RALC . . . Vacaville, California . . . Large concrete RatedAeration plant using "Chicago" sewage equipment throughout for more effective treatment. Capacities from 60,000 GPD. Engineer—M. Carlton Yoder. Ask for Bulletin 135-A.

RAMC . . . Hialeah, Florida . . . Above ground installation of a medium concrete treatment plant. Packaged standardized, balanced equipment for flows from 7,500 to 60,000 GPD. Engineer—Loyd Frank Vann Associates. Ask for Bulletin 135-A.



RASS . . . Meterie, Louisiana . . . Small steel, circular factory fabricated sewage treatment plant for communities from 10 to 500 people available in 1, 3, & 5,000 GPD capacities. Engineer—Curtis & Davis. Ask for Bulletin 136.

© 1961—CP-FMC

"from Chicago"

RATEDAERATION SEWAGE TREATMENT EQUIPMENT FOR EVERY FRINGE AREA SEWAGE NEED

Odor free, nuisance free, low cost, small package steel or large concrete plants . . . 1,000 to 1,000,000 GPD

Whether steel or concrete units, *all* RATEDAERATION systems obtain the same degree of high treatment through aeration. Proved successful in more than 950 installations, RATEDAERATION units are always economically expandable for area planning of future sewage systems.

There is a small packaged RATEDAERATION unit specifically designed to provide any fringe area with reliable, continuous sewage treatment at low original cost . . . and with low operating expense.

For further information call your local Chicago Pump distributor or write Chicago Pump for bulletins listed above.

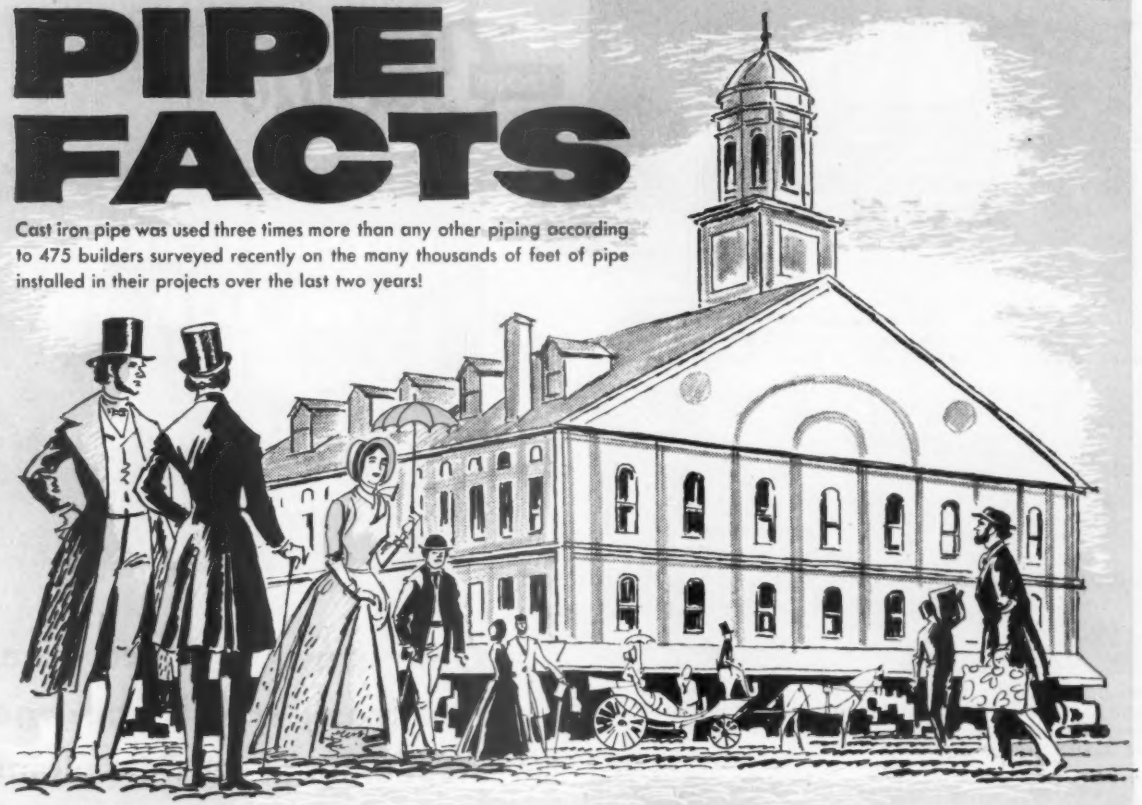
fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

Putting Ideas to Work

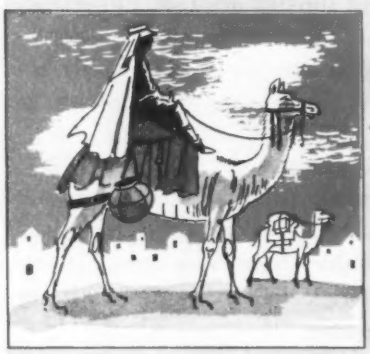
FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION
CHICAGO PUMP
DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

PIPE FACTS

Cast iron pipe was used three times more than any other piping according to 475 builders surveyed recently on the many thousands of feet of pipe installed in their projects over the last two years!

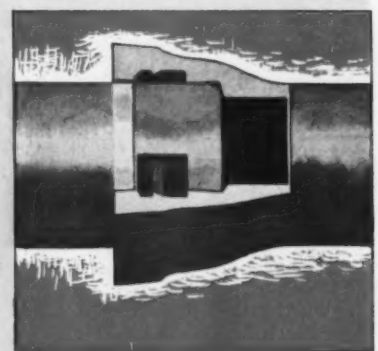


DO YOU KNOW that President Kennedy's great-grandfather landed in Boston in the late 1840's... about the time that Boston's first cast iron water mains were installed? That same cast iron pipe—installed in 1847—is still in service. It is not surprising that more than 100 years later, cast iron pipe continues to be used extensively in Boston's water distribution system.



DO YOU KNOW that camels can go as long as two months without drinking water? For the rest of us, water is a daily necessity... residents of St. Louis, for example, consume 226 million gallons of water on peak days, or 156,944 gallons per minute!

DO YOU KNOW that service taps in cast iron pipe are far stronger than those in composition pipe? Direct force on the corporation cock installed in 6" Class 150 AMERICAN cast iron pipe resulted in breaking the service cock at 1,640 pounds. The corporation cock was torn from the wall of a similar class and size composition pipe at 940 pounds. And the pipe wall failed!



DO YOU KNOW that the AMERICAN Fastite Joint requires only a single joint component ... a superior, double-sealing gasket ... for each 18 or 20-foot length of pipe? Each joint on a 13-foot length of composition pipe requires two gaskets...a double joint with consequent double liability.

AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM ALABAMA

WATER & SEWAGE WORKS

VOL. 108 **NO. 3**

MARCH **1961**

A Scranton Gillette Publication

E. SCRANTON GILLETTE
Publisher

V. W. LANGWORTHY
Editor

C. F. GURNHAM
Consulting Editor

Contributing Editors

D. P. Backmeyer — R. E. McKinney
J. R. Baylis — R. C. Merz
P. D. Haney — A. M. Rawn
C. E. Keefer — R. W. Simpson
J. F. Dye — W. A. Cawley

CHICAGO OFFICE: 185 N. Wabash Ave.
E. S. Gillette, Publisher
H. J. Conway, Adv. Ed.
V. W. Langworthy, Editor
E. J. Hoeffer, Asst. Editor
E. E. Halmos, Jr., Construction Editor
W. W. Hamilton, Western Sales Mgr.
M. C. Barr, Circulation Mgr.
R. J. Rooney, Make-up Editor
R. L. Fienberg, Copy Editor
M. McGinnis, Edit. Secy.

NEW YORK OFFICE: 155 East 44th St.
T. M. Todres, Administrative Assistant
Wm. R. Joyce, Midwestern Sales Mgr.
Terence McCoy, Eastern Sales Mgr.

85 Post St., San Francisco 4, Calif.
Duncan A. Scott & Co.
1901 West 8th St., Los Angeles 5, California
Duncan A. Scott & Co.

1201 Forest Lane,
Birmingham 9, Ala.
Fred W. Smith, Sales Rep.

Published and Copyrighted 1961
by Scranton Publishing Co., Inc.

Contents

FEATURES

San Diego Has Its Own Lime Recalcining Plant
by Frank I. Kohanowski — 81

Fundamentals of Sludge Digestion
Part II—Biology and Operation
by Gerson Chanin — 85

Boston's Deer Island Sewage Treatment Plant
(A Pictorial Report) — 89

Nitrate as the Nitrogen Source in BOD Dilution Water
(Research Progress Report)
by Peter E. Gaffney and Robert S. Ingols — 91

Sewage Flow Regulators
by Max B. Phillips — 96

Dial Indicating Pressure Gauges
by W. L. Buffenmyer — 98

The Obligation of the Water Utility to the Community
by Thomas W. Moses — 102

Me For Management
by Partially Oriented — 104

Filter Rehabilitation as Influenced by Filter Bottoms
by M. L. Stuppy — 105

Accounting Problems in Rate Regulation
by W. B. Gamble — 109

Lubricating Centrifugal Sewage Pumps Wearing Rings
by C. E. Keefer and H. S. Becker — 113

Two-Way Radio Is Johnny-On-The-Spot
by William Mahoney — 117

AWWA Directors Meet — 120

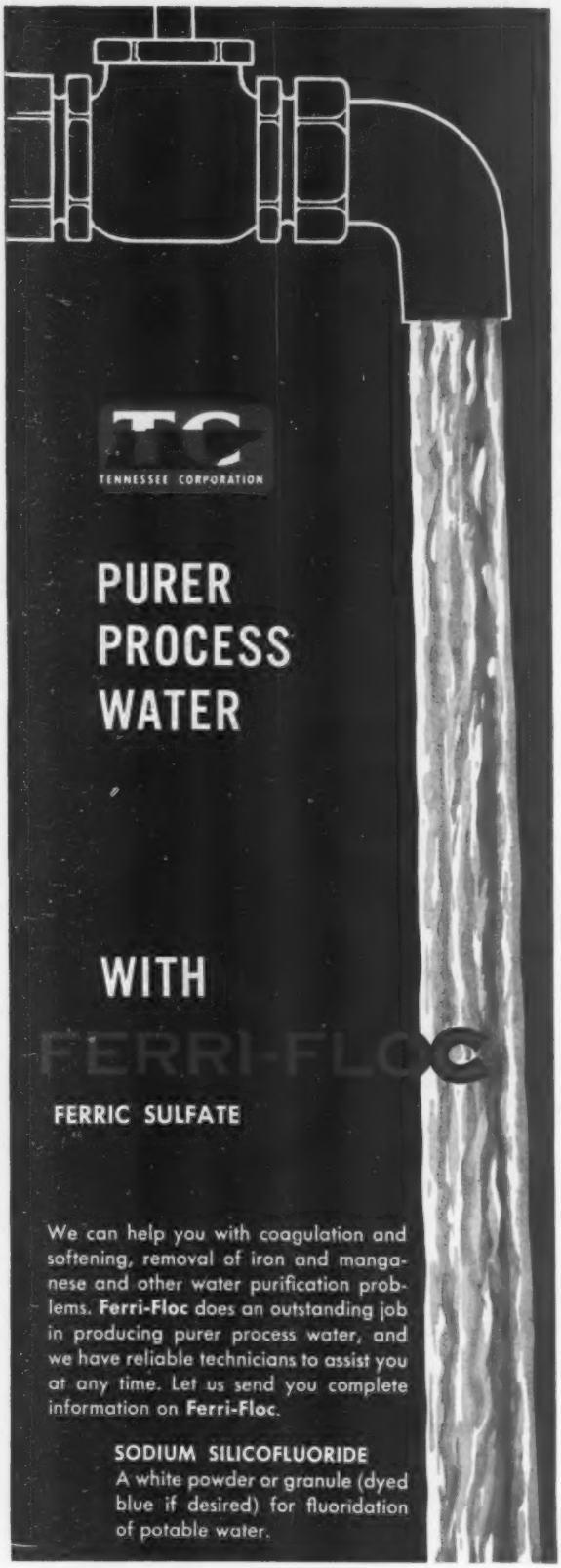
Editorials — 122

DEPARTMENTS

Meetings 4A
Washington Viewpoint 6A
News—Here & There 10A
New Literature 101A
Keep 'em Rolling 88A
Equipment News 92A
News of Suppliers 99A

FUTURE FEATURES . . .

Fuzing the Phenol Frenzy
Basic Biology of Stabilization Ponds
A Nomograph for Selection of Pipe Classes


TC
TENNESSEE CORPORATION
PURER
PROCESS
WATER
WITH
FERRI-FLOC
FERRIC SULFATE
We can help you with coagulation and softening, removal of iron and manganese and other water purification problems. Ferri-Floc does an outstanding job in producing purer process water, and we have reliable technicians to assist you at any time. Let us send you complete information on Ferri-Floc.
SODIUM SILICOFLUORIDE
A white powder or granule (dyed blue if desired) for fluoridation of potable water.
TC TENNESSEE CORPORATION
612-629 Grant Building, Atlanta 3, Georgia

Meetings WHAT WHEN WHERE

1961

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	2	3	4	5	6	7				1	2	3	4				1	2	3	4
8	9	10	11	12	13	14	5	6	7	8	9	10	11	5	6	7	8	9	10	11
15	16	17	18	19	20	21	12	13	14	15	16	17	18	12	13	14	15	16	17	18
22	23	24	25	26	27	28	19	20	21	22	23	24	25	19	20	21	22	23	24	25
29	30	31					26	27	28					26	27	28	29	30	31	

APRIL							MAY							JUNE						
						1		1	2	3	4	5	6					1	2	3
2	3	4	5	6	7	8	7	8	9	10	11	12	13	4	5	6	7	8	9	10
9	10	11	12	13	14	15	14	15	16	17	18	19	20	11	12	13	14	15	16	17
16	17	18	19	20	21	22	21	22	23	24	25	26	27	18	19	20	21	22	23	24
23	24	25	26	27	28	29	28	29	30	31				25	26	27	28	29	30	
30																				

Mar. 16—Medford, Mass. (*Tufts University Hotel*) NEW ENGLAND SECTION A.W.W.A. Secy., Ralph M. Soule, San Engr. ,State Dept. of Public Health, Boston.

Mar. 19-22—Little Rock, Ark. (*Marion Hotel*) ARKANSAS WATER & SEWAGE CONFERENCE. Secy., Dr. C. W. Oxford, College of Engineering, Univ. of Arkansas, Fayetteville, Ark.

Mar. 22-24—Chicago, Ill. (*LaSalle Hotel*) ILL. SECTION A.W.W.A. Secy., Dewey W. Johnson, Research Engr., Cast Iron Pipe Research Assn., 3440 Prudential Plaza, Chicago 1.

Mar. 27-Apr. 7—Cincinnati, Ohio (*Robert A. Taft Sanitary Engineering Center*) Trainging Course "Sani-Engineering Aspects of Nuclear Energy." Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to PHS Regional Office.

Mar. 27-30—St. Louis, Mo. AMERICAN CHEMICAL SOCIETY, Div. of Water & Waste Chemistry.

Mar. 30-31—Houston, Texas (*Rice University*) Industrial Section TEXAS WATER & SEWAGE WORKS ASSN. Write: Prof. A. W. Busch, Rice University, Houston, Texas.

Apr. 4-27—New Brunswick, N. J. (*Rutgers University*) Short Course: Introduction to Water Purification and Sewage Treatment. Contact Dean, College of Engineering, Rutgers, The State University, New Brunswick, New Jersey.

Apr. 5-6—Bluefield, West Virginia (*West Virginian Hotel*) WEST VA. SECTION A.W.W.A. Secy., Hugh W. Hetzer, Design & Construction Dept., Union Carbide Chemicals Co., Box 8361, South Charleston.

Apr. 5-7—Cincinnati, Ohio (*Sheraton Gibson Hotel*) SYMPOSIUM ON GROUND WATER CONTAMINATION. Sponsored by U. S. Public Health Service's Robert A. Taft Sanitary Engineering Center, Cincinnati. Write:

CONTINUED ON PAGE 177A

Briefs

San Diego Has Its Own Recalcining Plant which recovers softening plant sludge and thereby eliminates a disposal problem—page 81.

Fundamentals of Sludge Digestion. Part II (Biology and Operation) discusses the part bacteria play in digestion, the environment in which they live best, and the effects of adverse conditions on their activity—Page 85.

Boston's Deer Island Sewage Treatment Plant—This expansion project used wrought iron pump suction manifolds to solve several problems—Page 89.

Nitrate as the Nitrogen Source in BOD Dilution Water (Research Progress Report) tells how this chemical minimizes variations noted in long-term 20-day BOD values—Page 91.

Sewage Flow Regulators discusses the importance and necessity of having sewage flow regulators to regulate and control sewage flow to some portions of the sewage system—Page 96.

Dial Indicating Pressure Gauges must be selected properly to assure effective operation—Page 98.

The Obligation of the Water Utility to the Community is simply the assurance that an adequate water supply exists for the community and that planning has been taken to assure this adequacy for the future—Page 102.

Me For Management—Partially Oriented muses on his unusual management potentialities—Page 104.

Filter Rehabilitation as Influenced by Filter Bottoms describes work performed in 104 filter plants making alterations and improvements to filter bottoms—Page 105.

Accounting Problems in Rate Regulation explains in detail the problems private water companies have in presenting rate cases to regulatory agencies and to the public—Page 109.

Lubricating Centrifugal Sewage Pumps Wearing Rings—Baltimore's Bureau of Sewers has carried on an investigation for more than eight years to evaluate the use of waste oil as a means of reducing the wear on pump rings; the results on—Page 113.

Two-Way Radio Is Johnny-On-The-Spot—These units have proved to be money, time and labor-saving devices, helping the St. Louis Water Department provide efficient construction and maintenance operations—Page 117.

AWWA Director's Meet—A report on the January Directors Meeting, the men nominated for office, and what actions were taken—Page 120.

Editorials—Brief commentaries entitled, "AWWA Directors Consider Aims and Objectives" and "An Award and a Puzzlement"—Page 122.

News Report on Guantanamo Bay Water

The take-over by the Cuban government Sunday of the company that has supplied water since 1939 to the United States Naval Base at Guantanamo Bay will have little effect on the base, even if the water is shut off by Castro.

Two large water storage tanks, each of two million gallons capacity, were completed on the huge naval base last August by Electronic and Missile Facilities Inc. of New York City. Located on a hill overlooking Guantanamo Bay, the two tanks added more than half again to the base's water storage capacity.

Ships could bring fresh water from the U.S. and tie up at special facilities constructed in the middle of the bay. From there water could be pumped through pipelines laid on the floor of the bay and underground to the storage tanks. This speeds the discharge of water cargoes and eliminates the necessity of docking.

We Get Letters—Too

Beginning this month, W&SW will publish a sample of the many letters we receive from our readers.

If you have an "onion" or an "orchid", let us know. Meanwhile, turn to Reader Response and read what comments and opinions we have received. (Page 32A)

Water & Sewage Works is published monthly with an extra issue in August. Subscriptions including the Reference Number issue in the U.S. and Canada, 1 year $5.00; 2 years $7.50; 3 years $10.00. Other countries $1.50 per year additional. Single copies 50c except Reference Number $1.00.

MAIL SUBSCRIPTION ORDERS and CHANGES OF ADDRESS to Water & Sewage Works, 185 North Wabash Ave., Chicago 1, Illinois. Please allow four to six weeks for corrections to be effected.

E. Scranton Gillette, President; C. T. Gillette, Secretary; and H. J. Conway, Treasurer.

•

Water & Sewage Works, Reg. U.S. Patent Off. Published monthly by Scranton Publishing Co., Inc., at 185 N. Wabash Ave., Chicago 1, Ill. Entered as second class matter at the post office at Pontiac, Ill., under Act of March 3, 1879.

Washington Viewpoint

Congressman John A. Blatnik's expected bill (HR 4036), calling for $125 million a year in Federal grants for pollution control works, is interesting to water and sewage works men for many more reasons than the big jump in spending.

Perhaps most important from an industry and professional viewpoint is that Blatnik would remove stream pollution entirely from the control of the medical men of the Public Health Service. Instead, he'd set up an independent Water Pollution Control Administration, under a commissioner who'd report directly to the Secretary of Health, Education & Welfare. As you know, the question of whether the problem is a medical or an engineering one has been the subject of long debate both within HEW and in Congress.

Other key provisions include: A considerable increase in enforcement power to bring all navigable waters under Federal Authority, even without a showing of interstate pollution; pollution discharges from Federal installations would be made subject to HEW abatement orders; a $25 million construction grant fund would be established to aid impoverished communities ordered to construct facilities; establishment of field research and laboratory installations.

On the financial side, the bill would increase maximum Federal grants from $250,000 or 30 per cent of the cost (whichever is smaller) to $600,000 or 30 per cent; authorize re-allocation of unused state allocations to other states which have applications in excess of regular allotments; permit projects serving more than one municipality to receive a grant equal to the pro-rata total of each project's allowable grant.

It should be noted that the bill follows very closely on recommendations of two immensely influential bodies in Washington: The HEW's Water Pollution Control Advisory Board and the now-terminated Senate Select Committee on National Water Resources: Note the similarities:

The Advisory Board (reporting to new Surgeon-General Luther B. Terry) recommended: (1) Federal installations should be required to fully eliminate objectionable discharges; (2) the total support for research should be increased substantially; (3) construction grants should be raised to at least $100 million a year; (4) enforcement procedures should be strengthened, with emphasis on power to handle intrastate siuations; (5) the program should be "elevated" within HEW, and the entire operation concerning water pollution control held together as a single entity.

The Select Committee, winding up nearly two years of study, also called for much expanded national interest in pollution control problems, area-wide approaches to the problems, spending of billions over the next 20 years to insure a safe, adequate supply of water for industrial and domestic (as well as recreational) purposes. In connection with the Senate Committee report, incidentally, you should be cautious about reading totals—some news accounts said the committee "called for" spending of up to $200 billion. Fact is the committee "called for" spending nothing at all: Its members and staff emphasized to W&SW that the report is an outline and a guide for Congress, not a definite 20-year program.

With this kind of support—and with strong boosts from the Kennedy Administration—there's little doubt that some version of HR 4036 will get through this session, though the dollar total may be trimmed. You'll recall that a similar bill (also by Blatnik) was passed last session, but failed to muster enough support to override a veto.

* * *

Although Congress seemed to be engaged principally in spinning its wheels in the first two months of the session (it had passed only one major bill in that time), there was no lack of action in Washington that would affect the construction industry and the sanitary field.

On the executive level, President Kennedy had about completed appointments to fill out his administration's top policy-making posts and had directed the Community Facilities Administration to ease loans for public works so that almost anything a community wanted to build might qualify, rather than only sewer, water and gas works as previously limited.

* * *

Incidentally, Mr. Kennedy was demonstrating another aspect of U.S. life: The presence of a practicing politician in the White House. Unlike Eisenhower, Kennedy was himself announcing forthcoming legislation, and leaving no doubt that he was behind it. And he was showing no hesitancy in using the full powers of his office to get his way. For instance, new Secretary of Interior Stewart Udall made no bones in press interviews of the fact that he'd used some "persuasion" on reluctant Congressmen in the fight over enlarging the rules committee.

Another example of these tactics was contained in the handling of HR 3935 (Roosevelt, D. Calif.)—where the President announced at a press conference that a wage bill would be submitted, then the bill was dropped into the hopper. Roosevelt's bill is actually a slight rewrite of the measure Kennedy himself pushed (as a Senator) last year. It provides for covering an additional 4.3 million workers, raising the minimum wage "floor" to $1.25 an hour in two steps.

Of concern to engineers and contractors is the definition of firms to be covered: Any business concern (except contractors), doing a gross business of $250,000 a year is covered; construction firms doing a $350,000 business are included. It has been estimated that this provision will bring some 800,000 construction workers under provisions of the wage-hour laws. In addition, many employees of suppliers and service organizations may also be covered.

The one major bill approved by Congress so far may hold the key to whether there's any serious action this session on establishment of a Department of Urban Affairs. The bill is a simple renewal of reorganization powers for the President (the last such grant of power expired nearly 18 months ago). Under this power, the Chief Executive could set up a new department—if he gets approval from Congress.

However, it is worth noting that Congress refused to go along with Administration proposals that the method of Congressional approval of reorganization plans be changed: Administration stalwarts wanted approval to rest on a numerical majority of Congressmen—without regard to who was actually present at the time of a vote (thus 51 votes in favor would OK reorganization plans, regardless of whether the full membership of the Senate was present). However, Congress insisted on retaining the provision that approval must rest on a majority of Congressmen present and voting.

This action indicates two things: Congress is in no mood—as predicted—to rubberstamp Administration proposals; and Congress will insist on maintaining a strong control over shifts in the Executive branch.

* * *

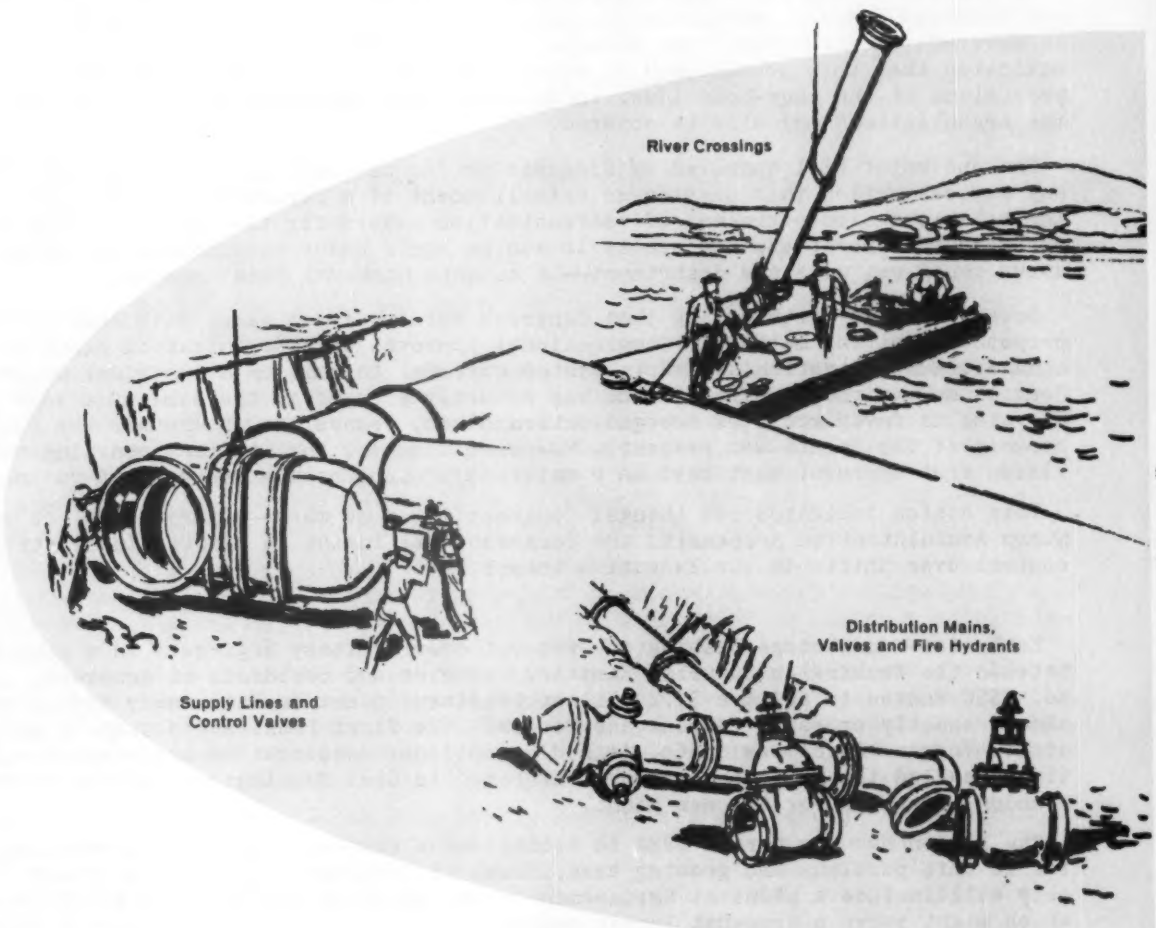
Esthetics—and George Washington—won out over sanitary engineers in a dispute between the Washington Suburban Sanitary District and residents of Accokeek, Md. WSSC wanted to build a $2.2 million treatment plant on Piscataway Bay—a site almost exactly opposite (across the Potomac) the first President's stately mansion at Mt. Vernon. Local residents—joined by national conservation group representatives—called the proposed plant an "affront" to Gen. Washington, and forced WSSC to abandon its plans for the new plant.

The action has now forced WSSC to reconsider a five-year plan for developing service to this populous and growing area, south of Washington itself. New plans probably will include a plant at Mattawoman Creek, 18 miles further down the Potomac, which might serve a somewhat larger region.

* * *

CLOW

Products for every job!



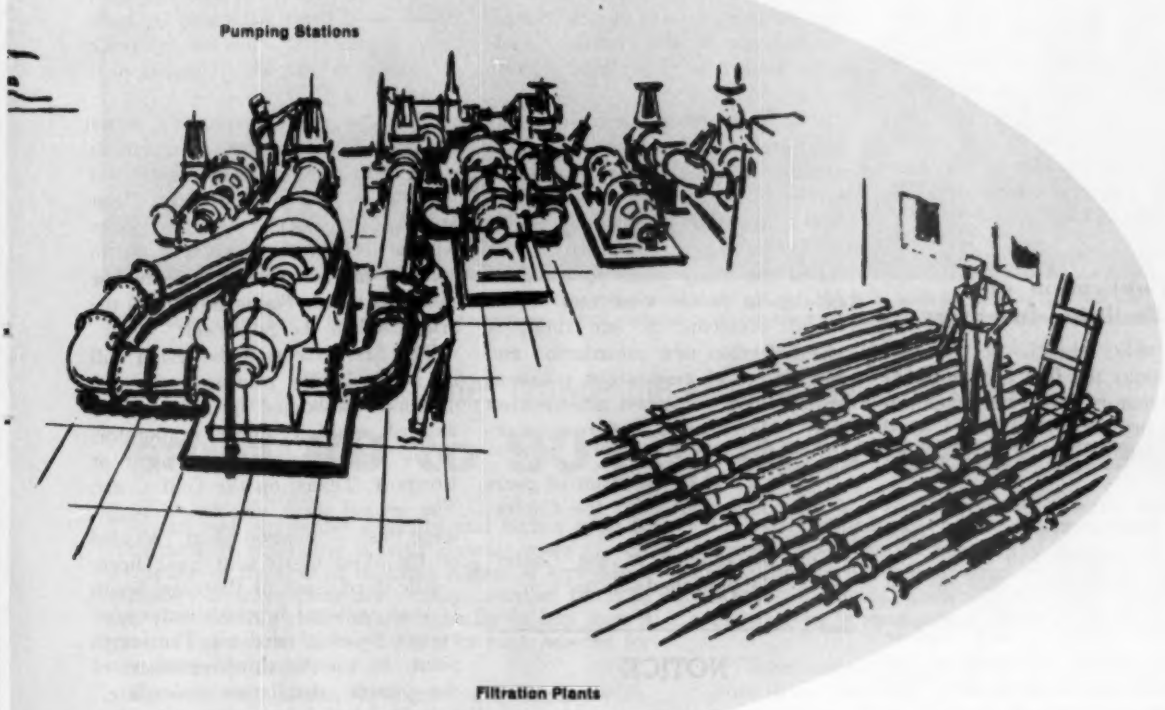
MEET EXACTING SPECIFICATIONS FOR PLANT & DISTRIBUTION SERVICE

For generations...since 1878...public officials, waterworks engineers and contractors have learned to count on CLOW products. Today, whether the need is for superior cast iron pipe, high quality hydrants, valves or fittings, or other waterworks specialties, CLOW products meet the exacting demands of plant and distribution service. CLOW facilities, experience and manufacturing skill are often invaluable in helping solve community pipe problems...in long line or extension mains, fire protection systems, filtration plants, pumping stations ...wherever distribution and control of water under pressure is involved.

Be sure...specify time-tested CLOW materials for *your* job.

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois
subsidiaries
EDDY VALVE COMPANY • Waterford, N.Y.
IOWA VALVE COMPANY • Oskaloosa, Iowa

CLOW CAST IRON PIPE



News—Here & There

Gustafson Heads ACS Water & Waste Chemistry Div.

Dr. H. B. Gustafson, chief chemist of Infilco, Inc., Tuscon, Ariz., has been named chairman for 1961 of the American Chemical Society's Division of Water and Waste Chemistry. He succeeds Dr. Robert S. Ingols, head of the department of applied biology at the Georgia Institute of Technology, Atlanta.

Chairman-elect is John J. Maguire of Betz Laboratories, Inc. Philadelphia. Dr. H. C. Bramer of the Mellon Institute, Pittsburgh, is secretary, and A. C. Reents of the Illinois Water Treatment Company, Rockford, is treasurer.

Dr. Gustafson attended Augustana College, Rock Island, Ill., and the University of Chicago, majoring in chemistry and chemical engineering. He joined Infilco, Inc., in 1928 as a chemical analyst.

A member of the ACS since 1931, Dr. Gustafson has served the Division of Water and Waste Chemistry as secretary for five years, as chairman-elect for 1960, and as a member of the executive committee. In the Southern Arizona Section of the Society he has been councilor, secretary, chairman-elect, and chairman. He was secretary of the ACS Divisional Officers Group in 1959 and chairman in 1960.

Begin Publication of Water Facilities Inventory

The Public Health Service announced today the first four volumes of an inventory of water facilities for the approximately 20,000 United States communities of more than 100 people.

The last similar inventory was made in 1947-8. For the first time the new compilation will include the names of communities that do not have any public water supply.

The new inventory will disclose information about ownership of the water facility, age of equipment, type of laboratory control, number of meters, source of supply and safe yield of water, and types of water treatment, i.e., aeration, chemical, mixing device, etc.

G. E. McCallum, Chief, Public Health Service, Division of Water Supply and Pollution Control, pointed out that more than $12 billion are now invested in the municipal water supply business. He added that more than $1 billion annually are now being spent by the water works industry to provide new and maintain existing structures and equipment. Within the next 20 years, this annual expenditure is expected to double.

The complete set of nine volumes will be issued during the next few months in a series corresponding to the nine regions of the Department of Health, Education and Welfare. Statistical analysis of the data is now under way and results will be available at about the same time the basic documents are released.

Preliminary Report on National Conference

Highlights and recommendations of the National Conference on Water Pollution are contained in a 48-page summary report, "Clean Water: A Challenge to the Nation," made public today by the Public Health Service.

In a foreword to the report, former Surgeon General Leroy E. Burney said:

"The National Conference on Water Pollution will affect the economic and public health planning of our Nation for many years to come. It held up to public view one of the critical problems of our time; it helped develop new information and fresh points of view about pollution control; and it focused attention on many different areas where new action is needed."

Nearly 1,200 people from all parts of the country attended the Conference.

Full proceedings of the Conference will be published shortly.

NOTICE

The Annual Contractor issue of W&SW this year will be published in June.

Sea Water Conversion Methods to be Tested

Five demonstration plants are being planned by the U. S. Office of Saline Water (Department of the Interior) to test five different methods of converting saline or brackish water to fresh water.

Success, which would mean the production of fresh water for about twenty cents per thousand gallons, to make it practicable for irrigation purposes, may be reached "before too many years," according to Ralph A. Morgen, President of Rose Polytechnic Institute, Terre Haute, Ind., who spoke at a recent AICE symposium on water supply.

"Enough basic information is available and enough engineering know-how can be brought to bear to produce fresh water from sea water successfully at a cost of somewhat less than one dollar per thousand gallons. There are many regions in the world where such use for human consumption is reasonable and desirable. However, the problem will not be solved finally until fresh water can be made from sea water at a low enough price to justify its use for irrigation purposes."

Three of the government's water conversion plants are designed to change sea water to fresh water, and will be located on the East, West and Gulf Coasts. The other two plants will be located "in areas suitable to convert brackish water, one in the Northern Great Plains and one in the arid areas of the Southwest."

The first process to be tested will be a distillation process using the principles embodied in a long tube vertical multiple effect evaporator. "This will be done in a plant at Freeport, Texas, on the Gulf Coast. The second plant will be "a multi-stage flash distillation plant," located on the West Coast near San Diego.

The third plant, at Webster, South Dakota, will test brackish water conversion by electrodialysis. The fourth plant, to use "a third variation of the generic distillation procedure," will be located near Roswell, New Mexico. No site has yet been selected for plant No. 5, which will test "a direct freezing process."

CONTINUED ON PAGE 12A

ALLIS-CHALMERS

The two Bascule gates at the Lake deForest Dam, Spring Valley Waterworks & Supply Co., N. Y., each 50 feet long by 5 feet high. A-C also provided 24- and 12-inch Howell-Bunger free-discharge valves, installed in the left-hand abutment, to regulate minimum flow requirements.

Bascule gates provide the extra storage you need...

save 80 to 90% of new dam costs

You can add impressive capacity and higher head to your dam by equipping it with *Bascule* gates . . . at a fraction of the cost of building a dam of equivalent capacity. *Bascule* gates are readily installed for both new and existing reservoirs, frequently in less than 9 months (compared to the 2 years or more needed for new dam construction).

By their very nature, these gates add capacity without requiring overhead structures and without increasing flood level, a dual problem not resolved with other gates. Since they discharge over the top, level regulation is facilitated . . . ice goes over the top, so they can function as ice breakers.

There's added safety too: extreme water pressure can initiate hydraulic lowering of the gate to maintain safe upstream or reservoir water levels. The result: a fail-safe installation. Or, where downstream conditions are the concern, a mechanical operator can be employed.

• • •

These unique Bascule gates are one more exclusive from Allis-Chalmers . . . proof again that A-C is your surest source of water control equipment designed to stretch investment dollars. For details, contact your local A-C representative or write to **Allis-Chalmers,** *Hydraulic Division, York, Pennsylvania.* A-1417

Bascule and Howell-Bunger are Allis-Chalmers trademarks.

News—Here & There

CONTINUED FROM PAGE 10A

Northwestern Univ. Holds Conference on Environmental Engineering and Metropolitan Planning

A Conference on Environmental Engineering and Metropolitan Planning, two specialties vitally involved in increasingly complex urban life, will be held March 21-22 at Northwestern University's Technological Institute, Evanston, Ill.

Environmental engineers are concerned with such serious problems of America's growing urban areas as water supply and flood control, air and water pollution, human and industrial waste treatment and control, and atomic waste handling.

The purposes of the Conference, first of its type ever held, are: To exchange information on the latest technical developments in common problem areas; To create interest in more badly needed research; and To build closer cooperation between specialists in the two fields.

Sponsors are the Northeastern Illinois Metropolitan Area Planning Commission, the Technological Institute of Northwestern, and the U.S. Public Health Service. Cooperating in planning it are the American Institute of Planners, American Municipal Association, American Public Works Association, ASCE (Planning and Sanitary Engineering Divisions), American Society of Planning Officials, AWWA, and International City Managers Association.

General Waterworks Corp. Earnings Up

Preliminary estimates of 1960 earnings per share for Philadelphia's General Waterworks Corporation are almost double the 1959 results. Howard Butcher, III, President, has stated that, "while recurring earnings should nicely exceed 1959 results, the bulk of the increase will come from sales of investments and some subsidiary properties, mostly in the last quarter. Earlier earnings of a little under $3 per share look like the final answer."

Mr. Butcher pointed out that since General always pays regular stock dividends, all these earnings are being promptly put to work to increase future earnings. "Recurring earnings would have been still higher this year if we had not spent so much building aggressive sales forces and new products for our industrial subsidiaries. It is anticipated that earnings from industrial operations will be considerably higher next year as the result of this course of action."

It was also disclosed that the company's water, telephone and other earnings all hit new highs in 1960.

Drought Flow Study of Michigan Waters

A significant contribution to the basic understanding of the behavior of Michigan's waters is presented in "Drought Flow in Michigan Streams", a major study undertaken for the State's Water Resources Commission by C. J. Velz and J. J. Gannon of the State Department of Environmental Health, School of Health, University of Michigan.

The drought flow characteristics of 50 Michigan rivers are analyzed in the study which includes: curves showing the 7-day, 15-day, and 20-day drought flow for the most probable, the one in 5-year, the 1 in 10-year and the 1 in 20-year low flow; flow duration curves; and tables of minimum discharges for the summer-fall season.

A limited number of the reports are available to those with a special interest in this type of information.

Earl Devendorf Dies

Mr. Earl Devendorf, who retired two years ago as director of the Bureau of Environmental Sanitation in the New York State Health Department, died last December 28, at the age of 72. He had been a member of the Health Department for 40 years.

Since his retirement, Mr. Devendorf has served on the advisory board of the U.S.-Canadian International Joint Commission on Water Sanitation.

In addition to the above associations, he was State Water Coordinator during World War II and the Korean War, a chairman of ORSANCO, and a member of the Interstate Commission on the Delaware River Basin.

California Studies Plan for Equitable Water Charges

Governor Pat Brown has asked the California legislature to approve a two-price system designed to prevent "unjust enrichment" of large landowners who would use state water which will be made available under a $1,750 million bond issue approved last November.

Under the governor's proposal, a charge of $2.00 additional per acre-foot would be assessed for water used on more than 160 acres under single ownership. This surcharge would be an alternative to an acreage limitation, which was demanded earlier by the California Labor Federation and other groups.

Largest Continuous Transmission Pipeline

Lock Joint Pipe Company of East Orange, N. J. will spend $6 million in Oklahoma during the next two years for a temporary plant, labor, materials and other goods and services. The plant will supply 100 miles of 60 in. prestressed concrete pipe to be used in the largest continuous transmission pipeline ever built in this country. The pipe alone will cost $17 million.

The new pipeline will connect the recently completed Atoha reservoir in southeastern Oklahoma with the new reservoir to be built on the outskirts of Oklahoma City. Eventually, this project will double the water supply of Oklahoma City.

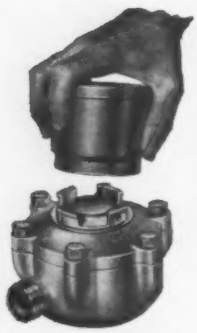
In late February, construction began on a temporary plant on 60 acres outside Ada, Oklahoma. The plant will employ approimately 175 people who will make 78 pipes 20 ft in length per day. In addition, the plant will make such special pipes as bends, "T's", outlets and air valves. These will be manufactured in advance and delivered "ditch-side" for installation. To meet construction schedules contractors will have to install between 50 and 80 pipe sections daily.

In the next two years, the plant will use 1,500,000 bags of cement, 120,000 tons of stone, 140,000 tons of sand, 10,000 tons of high tensile steel wire, 3,000 tons of steel plate for joint rings and 11,000 tons of sheet steel for watertight cylinders within the pipe walls.

MUELLER
for fast,
easy
service
connections!
Only with "quality-matched"
MUELLER Power Operated Tapping Machines,
MUELLER Combined Drill and Tap Tools and
MUELLER Corporation Stops can you be assured
of a dependable, leakproof service connection.
Write for complete information and specifications.
MUELLER CO. DECATUR, ILL.
MUELLER CO.
Since 1857
SERVING the Water and Gas Industries
QUALITY

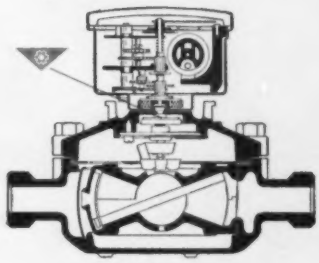
NOW THE FIRST MAGNETIC DRIVE

Only the Badger Easy-Read* offers . . .



REMOVABLE REGISTER

BOLD NEW FACE



SAPPHIRE JEWEL BEARING

Magnetic drive is even bigger news in Badger's Easy-Read water meter, where it combines with the long-accepted superiority of disc meter performance.

The new Easy-Read has no troublesome stuffing box, no consequent drags or leaks. It's sealed tight against water, dirt, fogging, tampering and corrosion.

But *only* the Easy-Read provides these: a low-friction, self-cleaning sapphire jewel bearing that acts as a buffer for the magnetic coupling . . . a new exclusive removable register . . . the largest, most readable face (its digits ¼" tall) of any meter.

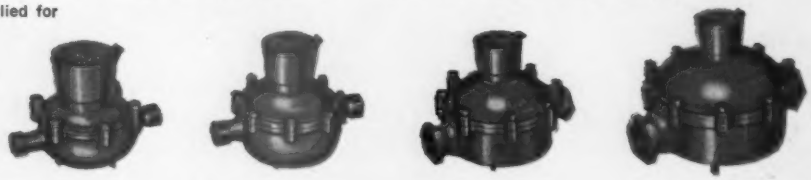
Plus interchangeability of parts—permitting you to modernize your present Badger meters just by replacing certain parts.

Easy-Read meters are made in ⅝", ⅝" x ¾", ¾" and 1" sizes in split case and frost-proof models. Also 1½" and 2" sizes in split case type. *Shown at right:* ⅝" x ¾" split case and (smaller illustration) ⅝" x ¾" frost-proof Easy-Read meters.

Ask your Badger representative for complete details. Or write to the address below for new, 4-page Easy-Read bulletin.

*Patent applied for

Split case Easy-Read meters



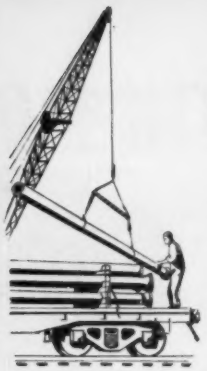
¾" 1" 1½" 2"

Badger Meter Mfg. Company

4545 West Brown Deer Road • Milwaukee 23, Wisconsin

METER WITH A DISC METER CHAMBER

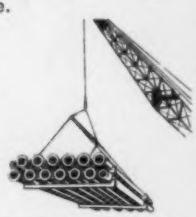
HOW MUCH IS IT COSTING YOU TO PUT THIS PIPE IN THIS POSITION?



DO YOU UNLOAD PIPE 1, 2, OR 3 AT A TIME?

If you do you'll find unloading *flat cars* easier, more economical than unloading from a gondola. Perhaps you already have the crane capacity to save even more man hours by using standard pallets especially designed for *Griffin-20** pipe. With a fork-lift, or a crane, you can unload 96 pipes in *four* or *eight* lifts. (One flat car of 6" pipe, or four double-pallets.) Or, if your crane is in use elsewhere, "skid" pipe directly to your truck or to your stockpile.

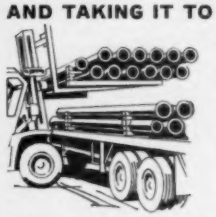
DO YOU STOCKPILE?



Our single-layer and double-layer pallets are specifically designed for multiple handling. Pipe remains palletized, ready for re-loading. Which pallet can your lift handle?

Single-Layer Pallets			Double-Layer Pallets		
Size	Pieces	Weight	Size	Pieces	Weight
4"	16	2½ tons	4"	32	5 tons
6"	12	3¼ tons	6"	24	6¼ tons
8"	9	3¾ tons	8"	18	7¼ tons
10"	7	3¼ tons	10"	14	6¼ tons
12"	6	3⅝ tons	12"	12	7⅜ tons

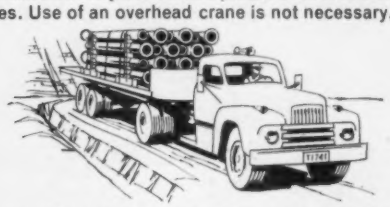
IF YOU STOCKPILE YOUR PIPE, WHAT IS YOUR COST FOR RE-LOADING IT AND TAKING IT TO YOUR JOB-SITE?



Pallets are designed for *quick* re-loading on trucks or flat-beds for installation-site delivery. You reap the benefits of a *double saving* in man-hours, since you save as much in re-loading as you do in unloading!

CAN YOU USE PIPE TRUCK-DELIVERED TO YOUR JOB-SITE?

All trucks for *Griffin-20* pipe are equipped with ropes and skids for easy trench-side placement of individual pipes. Use of an overhead crane is not necessary.



Remember...Ultimate cost is not what you pay for pipe, but how much it costs you to deposit it alongside trench.

*Griffin-20 trademark is the property of Griffin Wheel Company.

GRIFFIN PIPE DIVISION

GRIFFIN WHEEL COMPANY . . . COUNCIL BLUFFS, IOWA

CHICAGO AREA POrter 6-0452 • 850 East Green Street, Bensenville, Illinois Marvin E. Simpson, District Manager
Alex E. Kessler (East Troy, Wis.) Sales Representative

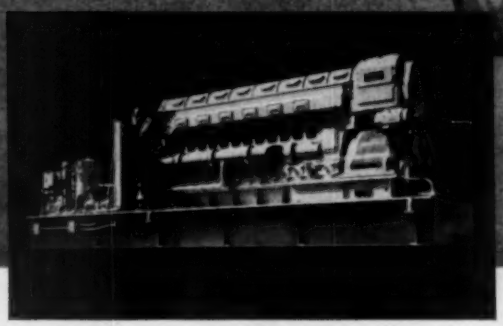
COUNCIL BLUFFS 322-6641 • 2601 Ninth Avenue
John L. Larson, Sales Representative

DENVER West 5-2427 • 1400 W. Evans Avenue
John M. Masterson, District Manager

ST. PAUL Prospect 6-1521 • 941 Johnson Parkway
William R. Colton, District Manager
Willard F. Klimmek, Sales Representative

KANSAS CITY, KANSAS DRexel 1-5690 • 1134 S. 12th Street • Thomas M. McGinley, Sales Representative

NOW! FULL POWER IS 15 SECONDS FAST!



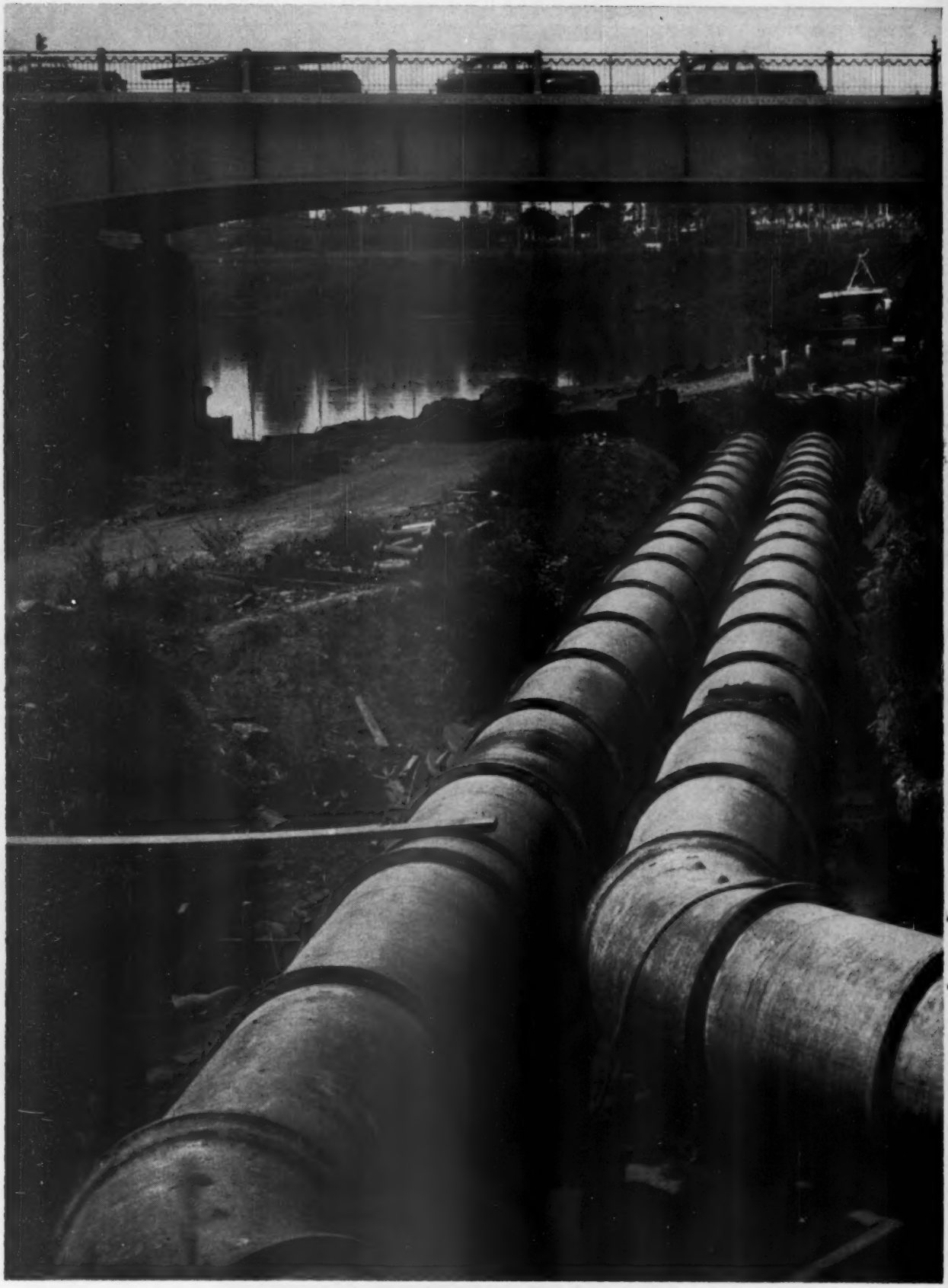
Solve peak-load and standby problems! F-M's exclusive O-P Diesel Generating Units provide *full* power in 15 short seconds . . . *from a cold start!* They need no spinning reserve. Use no power till you use them! The reason? Our exclusive O-P (Opposed-Piston) design. Two pistons in one cylinder function from a *single* combustion. This minimizes *vibration* . . . produces fine *balance*, *smooth* power to peak the generator—in just 15 seconds! F-M Opposed-Piston Diesel Generating Units are available with automatic or manual controls. Produce up to 2500 kw per unit. They may be linked in multiple units for peaking, standby duty . . . or dead load pickup! You can't buy better—or more economically.

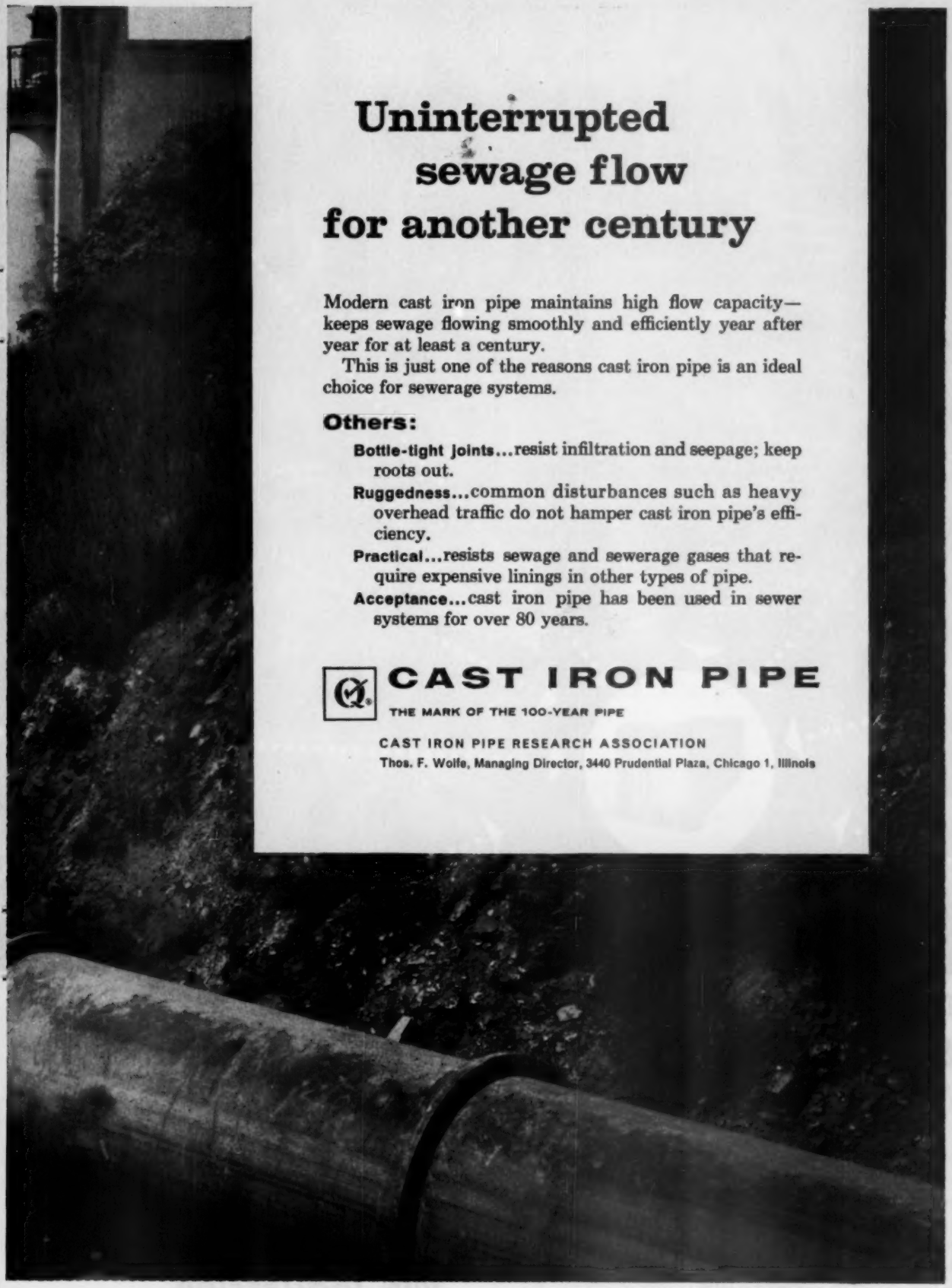
For full details or custom specifications, write today to: **Mr. S. K. Howard; Diesel Division; Fairbanks, Morse & Co.; Beloit, Wisconsin.**

FAIRBANKS MORSE

A MAJOR INDUSTRIAL COMPONENT OF

FAIRBANKS WHITNEY





Uninterrupted sewage flow for another century

Modern cast iron pipe maintains high flow capacity—keeps sewage flowing smoothly and efficiently year after year for at least a century.

This is just one of the reasons cast iron pipe is an ideal choice for sewerage systems.

Others:

Bottle-tight joints...resist infiltration and seepage; keep roots out.

Ruggedness...common disturbances such as heavy overhead traffic do not hamper cast iron pipe's efficiency.

Practical...resists sewage and sewerage gases that require expensive linings in other types of pipe.

Acceptance...cast iron pipe has been used in sewer systems for over 80 years.

CAST IRON PIPE

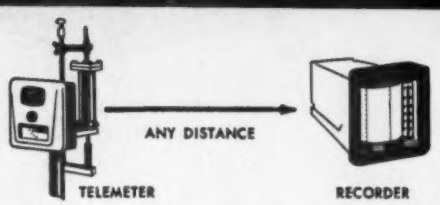
THE MARK OF THE 100-YEAR PIPE

CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

B·I·F FIRST . . . IN MEASUREMENT AND CONTROL OF MATERIALS FLOW

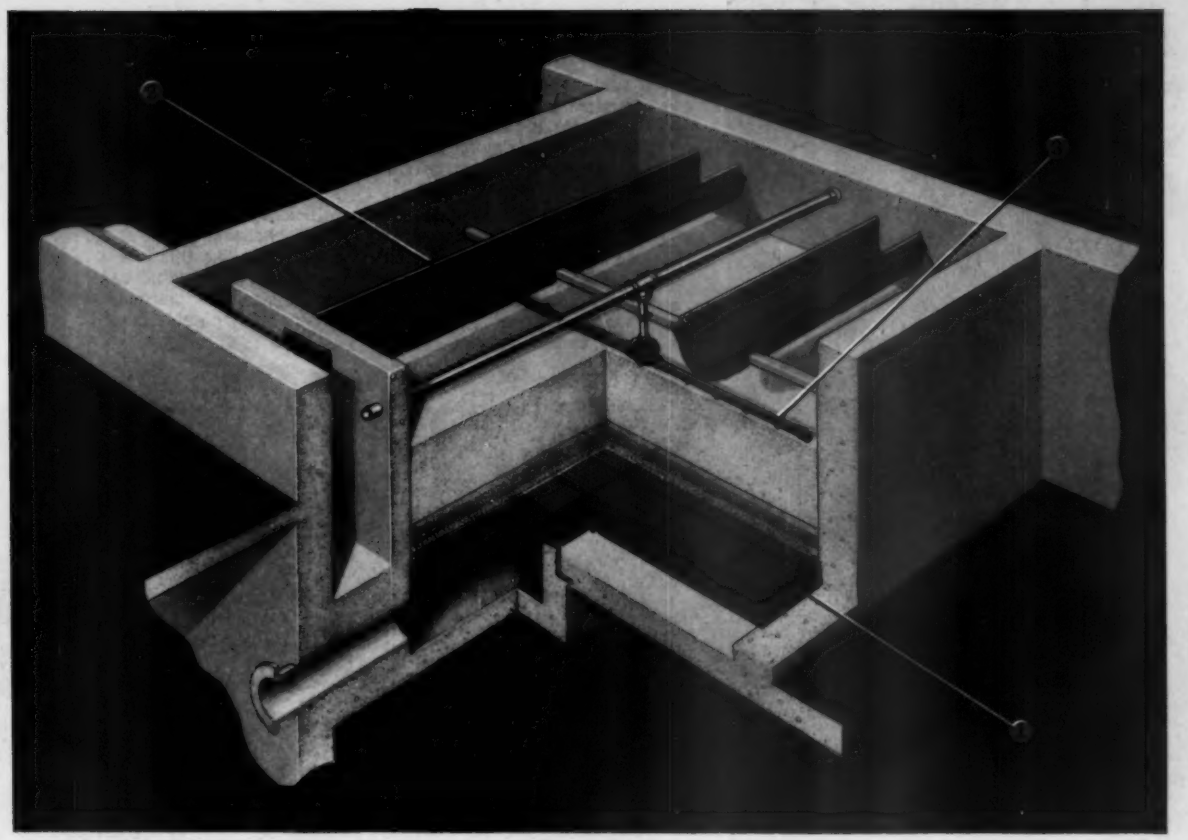
Where others fail... ***B-I-F*** *time-duration telemetering is infallible!*



Miles apart . . . pressure drops, a flow rate changes, a pump fails, a valve sticks . . . all must be instantly, dependably recorded at one central data-gathering station. As infallible as time itself . . . normal variations in line voltages, resistance, inductance, or ambient temperatures do not affect the B-I-F system. Power loss doesn't call for readjustment. Physical quantities are measured in their own terms . . . response is faster . . . need for elaborate off-normal alarm equipment is eliminated . . . all at great savings in cost! From the simplest tank level recording to complex central data handling, B-I-F has the know-how and experience in telemetering and remote control to help you operate more efficiently. Compare B-I-F Chronoflo Telemetering with any other. Request Bulletin 230.20-2 for complete details. Write B-I-F Industries, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

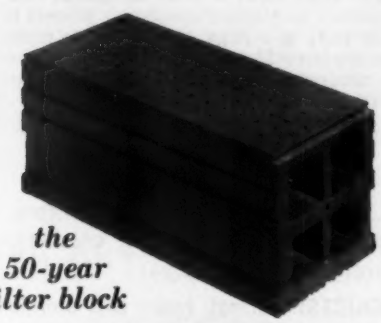
B·I·F **Industries**

BUILDERS-PROVIDENCE • PROPORTIONEERS • OMEGA METERS • FEEDERS • CONTROLS / CONTINUOUS PROCESS ENGINEERING



FROM TOP TO BOTTOMS . . . SPECIFY LEOPOLD

1. **Leopold Glazed Tile Filter Bottoms.**
2. **Leopold Fiberglass-Reinforced Plastic Wash Troughs.**
3. **Leopold Rotary Surface Washers.**



the 50-year filter block

Leopold

F. B. LEOPOLD CO., INC., Zelienople, Pa.

Exclusive Canadian Representative:
W. J. Westaway Co., Ltd., Hamilton, Ont.

Now you can specify an entire non-corroding filter installation from Leopold . . . your experienced source of supply. For lowest "over-the-years" cost, choose performance-proved Leopold glazed tile filter bottoms, built to last at least half a century. Tough Leopold fiberglass-reinforced wash troughs require no painting or other expensive maintenance. And new Leopold self-propelled rotary surface washers complete the package with a dependable product that's guaranteed for five years against mechanical and functional defects. Leopold filter plant equipment is used in thousands of plants throughout the country, on both new and rehabilitation projects. Choose these time-tested products by Leopold . . . for your complete filter needs. Write today for facts and figures.

F. B. LEOPOLD CO., INC., Zelienople, Pa.

☐ Please send literature on Leopold Glazed Tile Filter Bottoms.
☐ Please send literature on complete line of Leopold products.

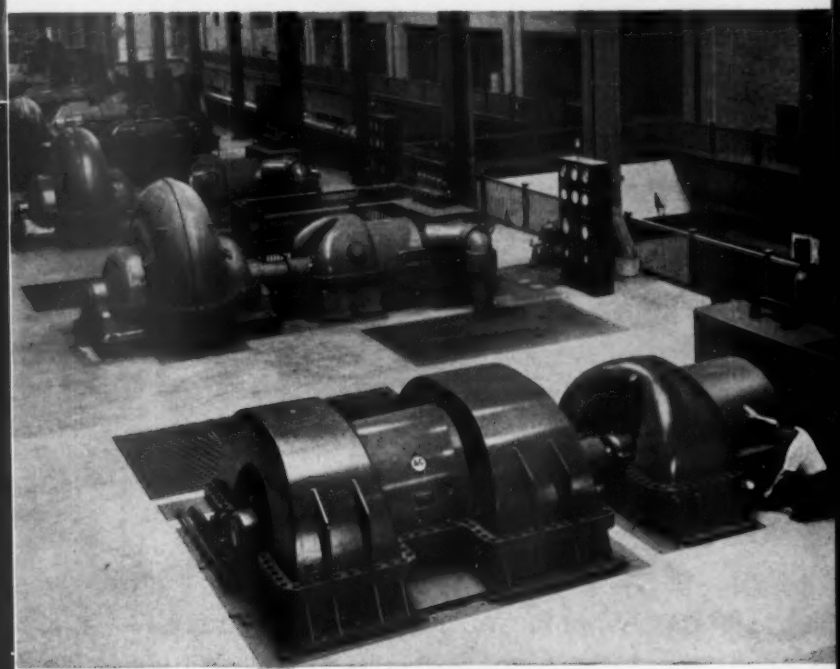
Name_____

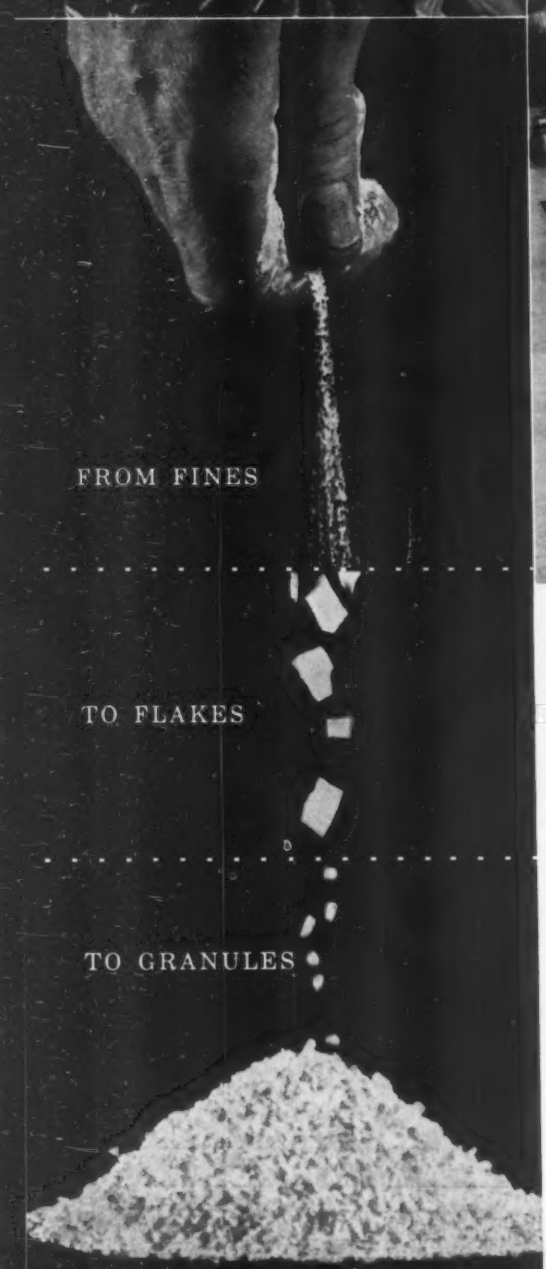
Affiliation_____

City_____ Zone____ State_____

New coil insulation means fast service: Here's downtime insurance you'll probably never need. The Silco-Flex insulation system on large A-C motors is so superior that coil failure is highly unlikely in ordinary service. Should failure occur, the usual 10-day rewind shouldn't be necessary. Usually eight hours should be enough for the entire job of replacing the coil.

Up to 15% greater compressor efficiency: Giving near constant capacity over a large variable discharge pressure range at high efficiencies, A-C axial compressors like this one . . . the first to be used for sewage aeration . . . are ideal base-load machines. They are up to half the size, one quarter less weight, 8% to 15% more efficient than comparable centrifugal compressors.





Fines from heat-dried sludge made useable: Heat drying of sewage sludge creates fines which fertilizer companies cannot use. An Allis-Chalmers continuous compacting process is now upgrading these fines at a large eastern city to make them saleable. Fines are formed into solid sheets, then broken into granules, then separated and sized for sale to a commercial fertilizer manufacturer.

A-C INDUSTRIAL EQUIPMENT DIVISION: motors, control, rectifiers, pumps, compressors, crushers, mills, screens, kilns, industrial systems.

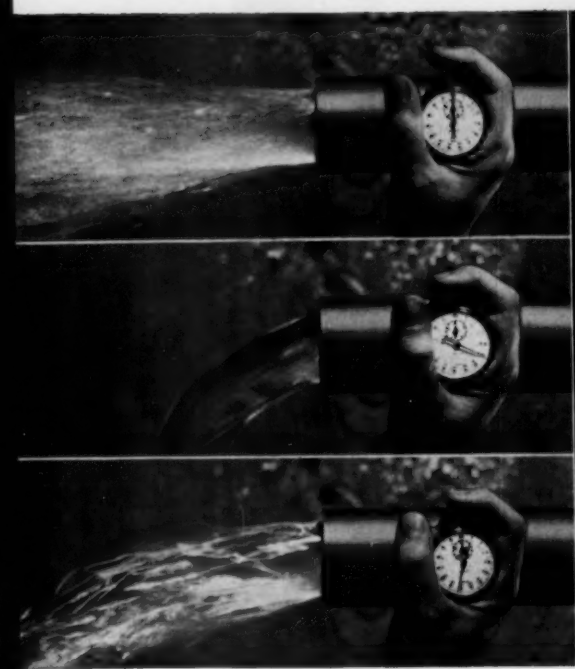
OTHER A-C PRODUCTS: thermal, hydro and atomic electrical generating equipment; switchgear, transformers, unit substations; tractors, earth-moving equipment, engines, lift trucks.

A-1398

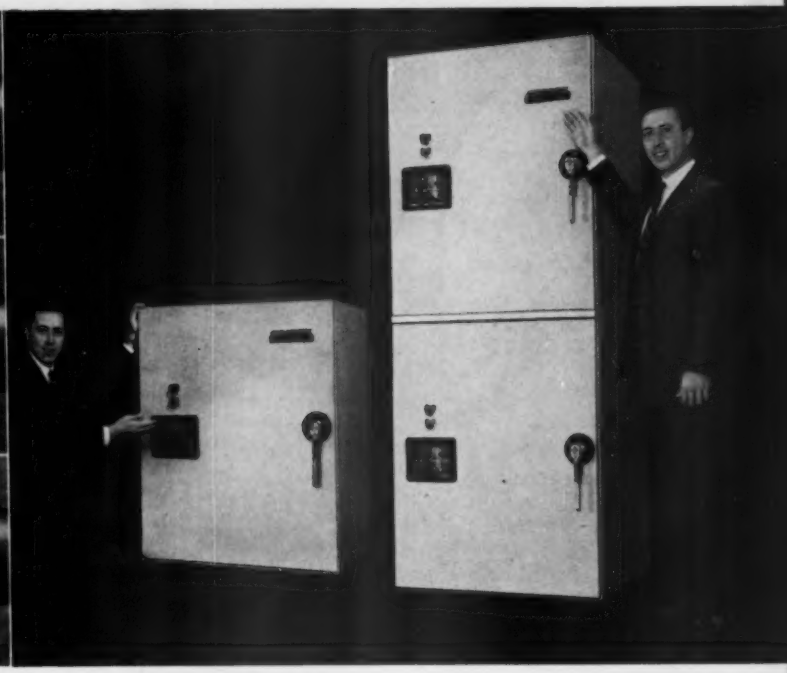
SpaceMaker, Pyro-Shield, Silco-Flex and ACAP are Allis-Chalmers trademarks.

ALLIS-CHALMERS

ideas and news:



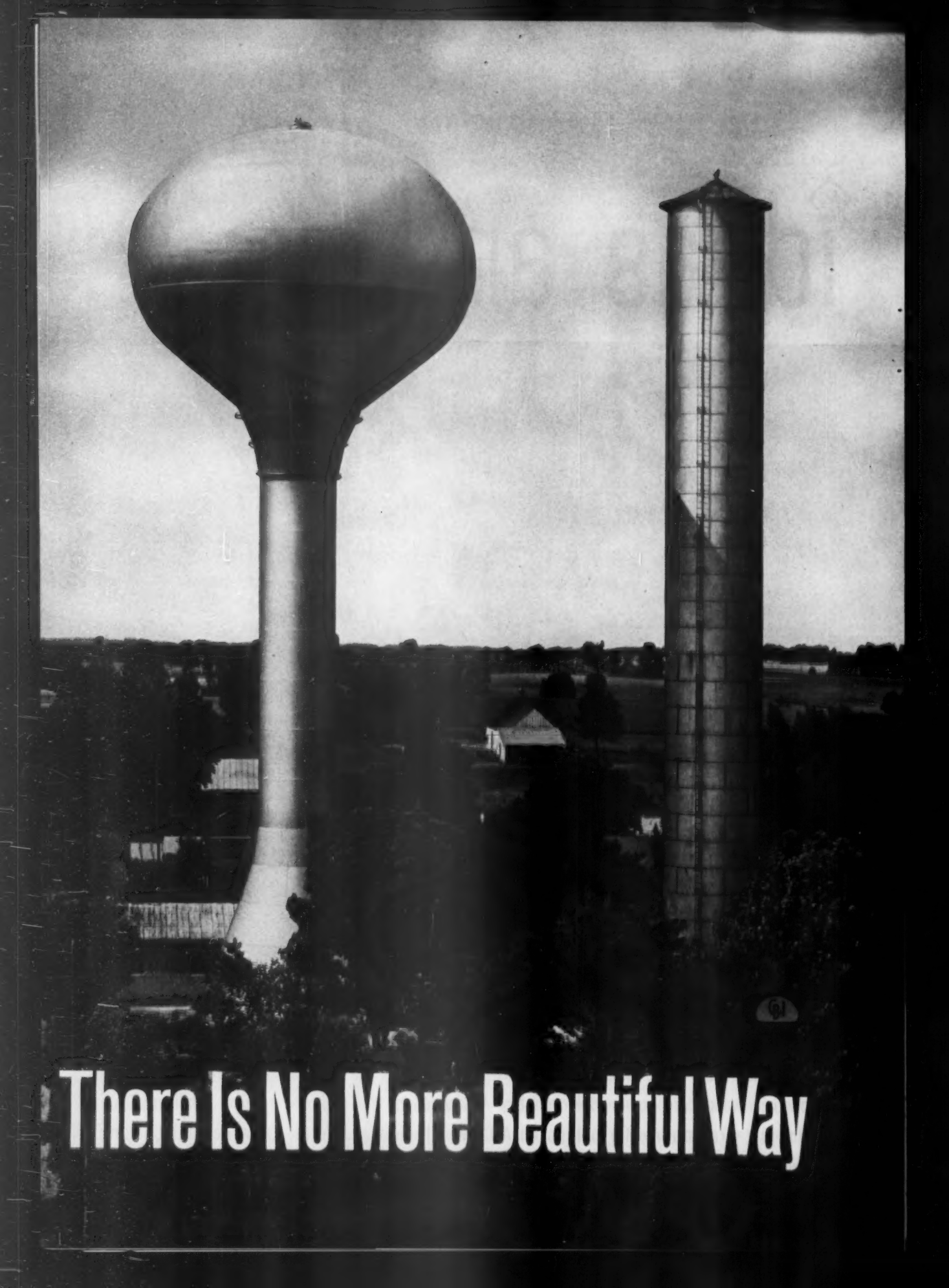
ACAP pump regulates flow instantly . . . without valves or varying pump speed. Proven ACAP (Adjustable Capacity, Adjustable Pressure) principle with internal pneumatic control automatically matches flow to demand. Regulation of flow through changing impeller clearances eliminates binding, plugging, saves power, allows system to operate at high efficiency regardless of demand.



So low, two fit where one used to go: This new SpaceMaker control center is the first completely new 2- to 5-kv motor controller development in more than a decade. New compact two-high design can cut floor space requirements in half. Complete drawout construction makes it the safest, most easily accessible controller on the market. New flame-retardent, track-resistant Super Pyro-Shield insulation adds to reliability, reduces size and weight. And, the all-new roll-out contactor has been designed specifically to cut maintenance time and costs.

Which of these productive ideas could be working for you?

A pump that adjusts automatically. A high-voltage motor control center. These examples demonstrate the extra value that is a standard with A-C . . . the greater efficiency and the added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Industrial Equipment Division, 904 S. 70th Street, Milwaukee, Wisconsin.


There Is No More Beautiful Way

Symbols of a Modern Community...

WATERSPHERES® AND WATERSPHEROIDS®

The remarkable advances in gravity pressure water storage are demonstrated by this dramatic photo showing a modern CB&I Waterspheroid and an old riveted standpipe.

When you modernize or add to your water storage facilities, consider the advantages of CB&I Waterspheres and Waterspheroids. Developments of CB&I's imaginative engineering in steel, they identify your community as a modern and progressive place to live. Ask for Bulletin A-40, "Modern Elevated Water Tanks."

Benefits of the Waterspheroid Design Include:

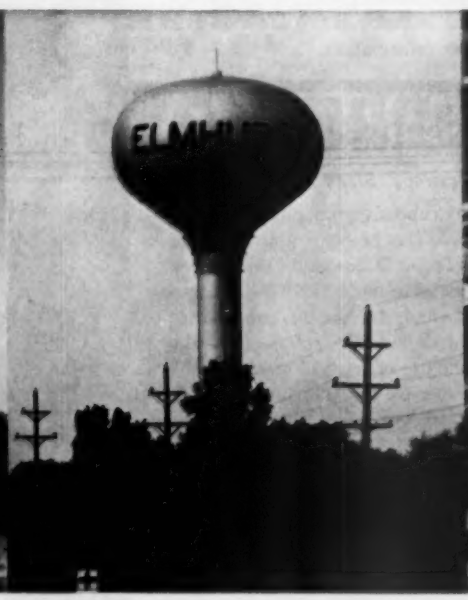
- Minimum ground area required
- Modernistic design to blend with landscaping and natural surroundings
- Utilization of base for pumping equipment or storage
- Elimination of external ladders
- Smooth surfaces from top to bottom reduce painting and maintenance costs

500,000 GALLON Waterspheroid, at left, has a head range of 37½ feet. The bottom capacity line is elevated 100 feet.

CB&I

Chicago Bridge & Iron Company
332 South Michigan Ave., Chicago 4, Ill
Offices and Subsidiaries Throughout the World

CB-6114



200,000 GALLON Watersphere, 37'8" in diameter, is elevated 98 feet to the bottom. Watersphere capacities range from 25,000 to 250,000 gallons.

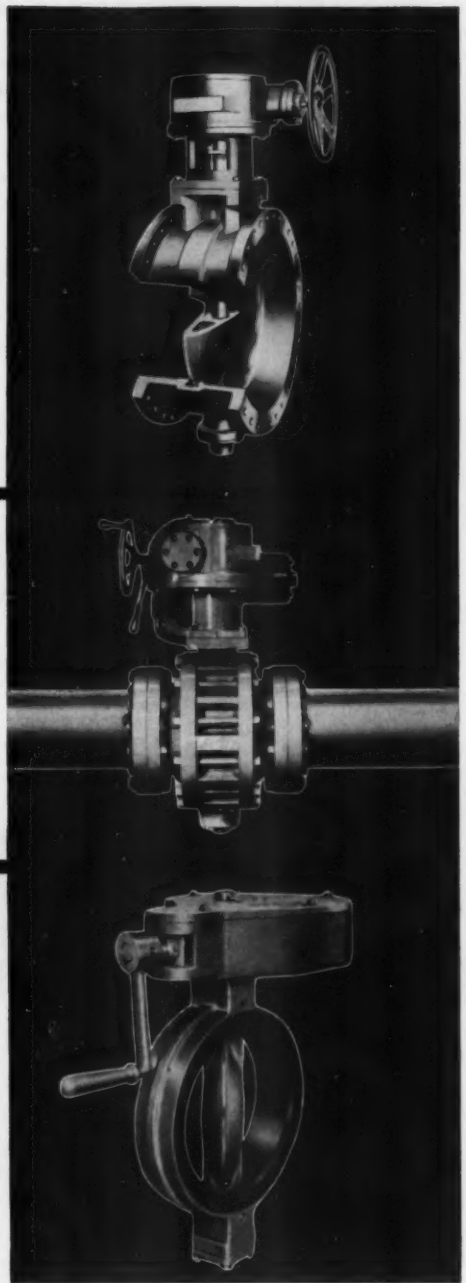
500,000 GALLON Waterspheroid draws attention to a modern community. Waterspheroids have capacities from 200,000 to 500,000 gallons.

400,000 GALLON Waterspheroid, in the center of a new residential development, provides gravity water pressure for general service and fire protection.

To Identify A Modern Community

WATERWORKS VALVES for the '60s!

These new, modern, rubber seat valves are especially engineered to meet the demands of the next decade—a decade in which dramatic population increases will place ever increasing loads on waterworks and sewage equipment.



NEW high pressure Butterfly Valves

for pressures to 150 psi. In sizes 4" through 72"

The R-2 series of Rubber Seat Butterfly Valves meet or exceed all AWWA Specifications for high pressure valves, and offer operating advantages far beyond basic requirements. The time-proven Henry Pratt features are now augmented by such new design features as: *Adjustable seat* that can be tightened (or even replaced) without removing shaft or disc. *Lower seating torque* lowers actuator cost and provides remarkable ease of operation. The R-2 is completely bubble-tight to 150 psi and offers longer operating life than ever before possible. Write for complete information.

NEW Pratt rubber seated Ball Valve

in 150 and 250 psi ratings. Sizes 10" through 48"

The famous Henry Pratt Company rubber seating philosophy has now been applied to the Ball Valve. This pioneering achievement enhances the inherent advantages found in Ball and Cone Valves. Just as the disadvantages of metal-to-metal seated gate and butterfly valves were eliminated, and the use of rubber seat butterfly valves made a waterworks industry standard by the original Pratt design, we expect the use of resilient seating in the Pratt Ball Valve to add a new perspective to waterworks valving.

Write for Bulletin BA-1B

NEW Monoflange Mark -II

for pressures to 150 psi. Sizes 4" through 20"

No valve is easier to install or operate. The Monoflange fits conveniently between existing pipe flanges—no gasket is necessary. With completely tight shut-off at 150 psi, the Monoflange Mark II finds many applications where economy is paramount, but long life is necessary. Fully complies with all structural and operator requirements of AWWA Specification C504-58 for rubber seat butterfly valves with the exception of body configuration.

A most complete 60 page catalog has been prepared which contains all necessary information. Write for Bulletin 10-B.

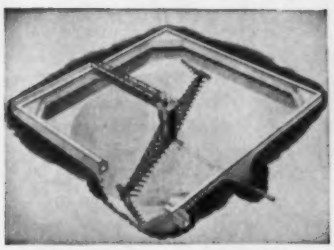
HENRY PRATT® Creative Engineering for Fluid Systems

HENRY PRATT COMPANY
319 W. Van Buren Street, Chicago 7, Illinois
Representatives in Principal Cities

PRIMARY AND SECONDARY SETTLING BASINS at O. N. Stevens water filtration plant, Corpus Christi, Texas, are equipped with Link-Belt Series "S" Circuline sludge collectors. This new 48-mgd plant can handle a 50% surge easily, 100% in emergencies.

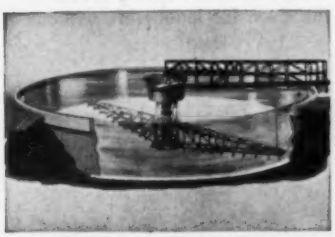
Four series of LINK-BELT Circuline collectors

offer positive sludge removal

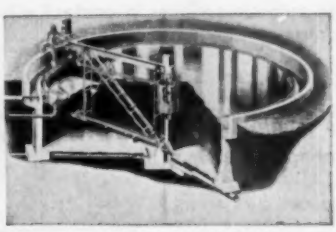


SERIES "S" — specially designed for square and rectangular tanks. As collector revolves, pivoted arms on ends of rakes adjust to thoroughly remove sludge from basin corners.

SERIES "R" — available in models for bottom feed, side feed or cross flow applications . . . in a wide range of sizes. Pitched blades gently convey sludge to center of tank.



SERIES "T" THICKENER — for rugged duty. Similar to "R" collectors except for heavier design. Furnished with fixed rake and automatic or manual lift types.



SERIES "C" — uses simple, positive traction drive to rotate bridge. Slow-speed straightline collector, with long-wearing, corrosion-resistant chains, removes sludge.

There's a design to fit any requirement of tank capacity or construction

THERE's no problem of septicity in settling tanks where Link-Belt Circuline collectors are used. Traveling smoothly and gently, they assure minimum disturbance of flow and the greatest possible concentration and removal of solids in least time.

This efficiency is typical of all the equipment in the complete Link-Belt line for water, sewage and industrial liquids treatment. And it testifies to the value of Link-Belt's more than 35 years' experience in sanitary engineering.

Link-Belt will gladly work with your consultants and chemists on *any* treatment problem. Call your nearby Link-Belt office. Send for Book No. 2546. 15.280

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. District Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World.

MORE THAN 25,000 DeZURIK VALVES in MORE THAN 765 SEWAGE PLANTS

are handling a variety of services!

This wide acceptance has made DeZurik THE MOST EXPERIENCED eccentric valve!

And NO other valve has all these features!

CORROSION RESISTANT BEARING BUSHINGS

Even after long periods of inoperation, DeZurik Eccentric Valves operate easily, without "freezing" or sticking, without the need for lubrication.

SMALL DIAMETER STEM BEARING

Because DeZurik stem bearings are minimal diameter, consistent with strength, there is less friction to overcome in operation of the valve, less operating torque is required.

LEAK-PROOF STEM SEAL

The DeZurik Stem seal is self-adjusting, under constant spring pressure, with multiple surfaces in contact with the stem for longer life without leakage.

REPACKABLE STEMS

Under normal sewage plant line pressures, DeZurik Valves can be repacked without shutting down the service, without removing the plug, without interrupting operation of the plant.

There are other advantages in choosing DeZurik Eccentric Valves . . . their compact size, long life, dependable service record . . . that make them the choice of more and more Consulting Engineers and Plant Operators. Get the complete story from the DeZurik representative in your area or write

DeZURIK CORPORATION
SARTELL, MINNESOTA

"Best salesman *our town ever had!*"

"It's a fact, Joe!

"Every person stopping in our town, even for only a few hours, samples our water...and gets a chance to judge us.

"The clear, fresh-tasting water we serve makes a good impression. It's the best salesman our town ever had."

What about the water supply in *your* town? Does it impress visitors favorably? Do townspeople compare it unfavorably with water they drink elsewhere?

If you aren't sure your water is *consistently palatable,* let AQUA NUCHAR's field representative survey your plant and recommend sound taste-and-odor-control procedures. Simple daily threshold odor tests and the accurately measured use of AQUA NUCHAR controls taste-and-odor at a cost of only a few cents a day.

Why not write or phone us today?

West Virginia Pulp and Paper

INDUSTRIAL CHEMICAL SALES DIVISION

230 Park Ave., New York 17 · Philadelphia National Bank Bldg., Philadelphia 7 · 35 E. Wacker Dr., Chicago 1 · 2775 S. Moreland Blvd., Cleveland 20

Hardly! You see, Transite®, the *white sewer pipe*, is made of ageless minerals—asbestos and cement. The asbestos fibers, each with the tensile strength of piano wire, reinforce the cement to form a stone-like pipe that is rugged, tough and durable. Transite is also steam-cured under high pressure, adding further to its strength, durability and chemical stability. And, being non-metallic, there's no chance of oxidation weakening its structure. What's more, Transite's high crushing strength can withstand the heavy overburden, ground movement and earth shocks that continually challenge the ability of sewer pipe. When you add to this Transite's long lengths, tight joints and naturally smooth interior, it becomes obvious that this white sewer pipe was designed to offer greater total life expectancy.

For all the facts, write for special data file. Please indicate if you are a city official, engineer or contractor. Address: Johns-Manville, Special Sewer Data, Box 14, WS-4, New York 16, N. Y. In Canada: Port Credit, Ont. Cable address: Johnmanvil.

The Transite Pipe shown in this 23-year-old photo is still providing trouble-free service.

JOHNS-MANVILLE
TRANSITE SEWER PIPE

JM

This is the chlorinator you can be proud of. Its handsome modern appearance reflects the advanced technology of its working parts. It is the first chlorinator ever to offer a complete regulator system in a single stack. There is no frail piping. Not even traces of moisture can feed back from the ejector. Any vacuum interruption stops operation . . . instantly closes the chlorine inlet valve. We believe it to be—inherently—the safest, most dependable, and most accurate chlorinator ever devised. It is also the most controllable. Controlomatic models accept any imaginable type of signal, use it to feed up to 2000 pounds per day of chlorine according to any control mode you may choose. Because of its advanced design, because of its corrosion-proof construction, we firmly believe that this is the chlorinator that will never—never—grow old.

If you choose to buy one of these chlorinators sight unseen, on our say-so, we can deliver immediately from warehouse stocks across the country. If not, your local F&P field office will be happy to demonstrate the 3400 Series at your plant, at your convenience. Call for an appointment. Or, write for complete information in Catalog 70C3400. Fischer & Porter Company, 131 Fischer Road, Warminster, Pa.

FP

FISCHER & PORTER COMPANY

INSTRUMENTATION AND CHLORINATION

These MANUFACTURING AFFILIATES carry Fischer & Porter engineering designs to the far corners of the earth: FISCHER & PORTER (CANADA) LTD., DOWNSVIEW, ONTARIO • FISCHER & PORTER LTD., WORKINGTON CUMBERLAND, ENGLAND • FISCHER & PORTER G.m.b.H., GROSSELLERSHAUSEN, BEI GOTTINGEN, GERMANY • FISCHER & PORTER N.V., KOMEETWEG 11, THE HAGUE, NETHERLANDS • FISCHER & PORTER Pty. LTD., 184 HANNA ST., SOUTH MELBOURNE, VICTORIA, AUSTRALIA.

Reader Response

Partially Oriented

Sir—. . . you must be receiving many favorable comments on the light, amusing page that appears to originate in merry England.

O. S. Davis
University of Alabama
University, Alabama

We are and it does—Ed.

Kudos for Mr. Murdoch

Sir—I want to thank you very much for sending me a copy of your compilation of laws applying to water supply, water quality and water distribution by John H. Murdoch, Jr. This is one of the finest collections of laws on this particular subject that I have ever seen. I think everyone should be grateful to WATER & SEWAGE WORKS for its publication and certainly grateful to John Murdoch for his magnificent effort in making the publication possible.

N. T. Veatch
Consulting Engineers
Kansas City, Missouri

Chlorination, right down the line. Dry, easy-to-use HTH Tablets—the modern way to chlorinate new mains . . . kill bacteria, algae and fungi fast. They release dependable, highly effective chlorine quickly . . . dissolve slowly to last longer. Economical, too—one tablet sanitizes many feet of pipe. HTH Tablets protect reservoirs, wells and filtration equipment, too. Comes in convenient cans, pails and drums. Write for literature.
Here's To Health . . .
HTH
HTH® is a trademark.
OLIN MATHIESON CHEMICAL CORPORATION
Chemicals Division • Baltimore 3, Maryland
7575

Water Quality and Instrumentation Symposium

Sir—. . . . I have read with interest your editorial (W&SW, December 1960) about the August Symposium. I am sure you will receive response from interested people. I think you will find some of my reactions in the enclosed manuscript . . .

Robert H. Jones
Applications Engineer
Beckman Instruments, Inc.
Fullerton, Calif.

Sir—. . . I read your interesting editorial (W&SW, December 1960) and would like to congratulate you in summing up the scope of the problem and what must be accomplished. As one who served as an independent consultant on industrial waste treatment for five years, followed by my present six-year tenure . . . with an instrument manufacturer, I must view the present situation (lack of pollution detection devices) with mixed emotions. You accurately stated that present efforts employing equipment originally developed for industry have not solved the problem.

Thomas J. Kehoe
Electrochemical
Supervisor
Beckman Instruments, Inc.
Fullerton, Calif.

Mr. Jones' manuscript and further remarks by Mr. Kehoe will appear in a forthcoming issue.—Ed.

Action and Less Words

Sir—It seems to me you have been citing (W&SW, December 1960) the "Cinderella" left after the get-together on the various problems confronting those who use shoeleather in attempting to stomp-out said problems. The suggestions appear to lay-on the "roof" in wait for the "foundation", either the ideas never get down to earth or off the ground. So I agree with your recent editorials on let's have some action and less words. Maybe some shoeleather-necks would help (in the conferences as well).

Richard E. Carpino
Public Health Sanitarian
Watertown, Conn.

Good Reporting Job

Sir—I wish to compliment you on the January issue of WATER and SEWAGE WORKS. This is one of the best jobs of reporting really important issues. Most of the trade journals are completely dominated by advertising and out-of-date articles, but your January issue demonstrates a good job of reporting.

A. P. Jones
Stauffer Chemical Company
Houston, Texas

Water and Sewage Works likes to hear from its readers. Reader Response will continue to air readers' beliefs, but keep them short and current, please. Send your response to Editor, Water and Sewage Works, P.O. Box 1315, Lansing Michigan.

In CANTON, OHIO*

TYLOX

RUBBER PIPE JOINTS

and

REXON PIPE COATING

"team up"

to prevent leaks and guard against corrosion of new city sewers

Engineers had their eyes on future as well as present costs when they designed Canton's recent sewer expansion project. Here's how their call for TYLOX-jointed, REXON-coated concrete pipe helps assure Canton citizens of "most for the money" from their tax dollar . . .

NO JOINT LEAKS – even under tough conditions like those shown in the top photo. TYLOX prevents infiltration . . . keeps treatment plant loads at a minimum . . . eliminates root and sediment penetration.

NO ACID ATTACK – even though industrial wastes may enter the line. REXON Coating (center photo) is resistant to virtually all acids, alkalies, greases and solvents. "Teamed up" with equally durable TYLOX Joints, the resulting line is corrosion-resistant *throughout*.

FAST PIPE-LAYING – Just shove gasketed pipe home (lower photo) and the TYLOX Joint is complete. Wet trenches do not delay the work, and the *flexible* TYLOX permits immediate backfilling.

* **PROJECT:** Stark County sewer expansion project, Canton, Ohio
ENGINEER: A. T. Hall, Stark County Sanitary Engineer
CONTRACTOR: Shulle Construction Co., Akron, Ohio
PIPE: Reinforced concrete, TYLOX-Jointed and REXON Coated, manufactured by United States Concrete Pipe Company, Cleveland, Ohio.

5062-3

Plan now to specify TYLOX Rubber Joints and REXON Pipe Coating on your next concrete pipe job and be assured of leakproof, corrosion-resistant lines laid faster . . . Write for more details today.

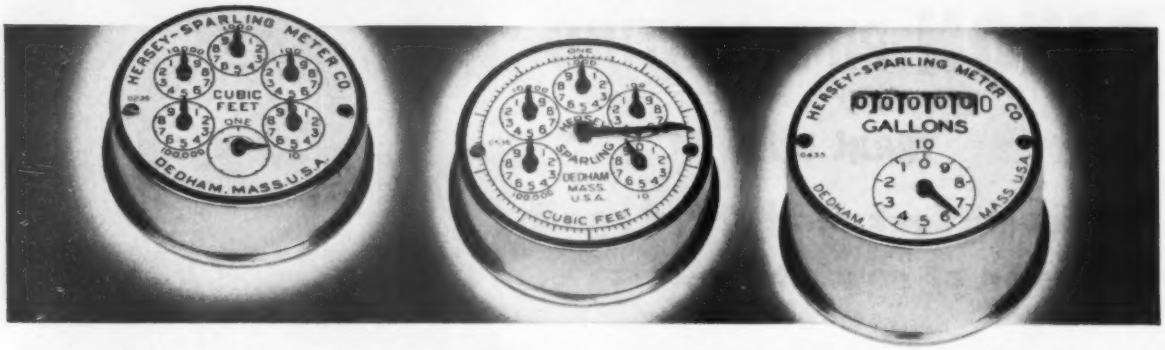
CANADIAN: 3194 Mavis Rd. Cooksville (Toronto), Ontario

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St. ORchard 3-9555

For Instant Unimpeded Water Flow



For Accurate Measurements of ALL Rates of Flow — You Can Depend on a

LISTED UNDER RE-EXAMINATION SERVICE UNDERWRITERS' LABORATORIES, INC.
UL
FM
LISTED BY UNDERWRITERS' LABORATORIES OF CANADA
ULC
Sizes 6", 8" and 10" of Model FM-CT are listed as standard under the re-examination service of Underwriter's Laboratories, Inc. and approved by Factory Mutual Laboratories for use in Factory Mutual insured properties, also listed by Underwriter's Laboratories of Canada.

HERSEY

Detector (FIRE SERVICE) Meter — Model FM-CT

This compound type meter combines a Proportional Meter and an Automatic Valve on the main line with an all bronze Compound Meter on the by-pass. Result: all rates of flow are measured with minimum loss of head and with minimum obstruction when full pipe capacity flow is demanded for an emergency, such as extinguishing fires.

Hersey-Sparling
Meter Company
HERSEY PRODUCTS
DEDHAM, MASSACHUSETTS

Branches: Atlanta, Boston, Chicago, Cleveland, Dallas, Denver, Kansas City, Mo., Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle

Activated Sludge Thickened to 4% (and more) with Rex Float-Treat®

This remarkable thickening rate was obtained with two Rex Float-Treat Thickeners installed in two pilot unit tanks, 13′4″ wide by 60′ long, at the Bay Park Treatment Plant, Nassau County, N. Y.

In fact, runs of substantial duration resulted in solids concentration greater than 5%—far exceeding the performance of the existing conventional gravity system. As a result of this performance record, six additional Rex Float-Treat Thickeners were purchased.

INCREASED CAPACITY... LOWER COSTS. Thickening with Rex Float-Treat Thickeners, as compared to gravity-type systems, produces much denser sludge concentrations, with far greater loadings. This results in two important advantages: 1. thickener tanks can now be much smaller; 2. with greater sludge concentration, overloaded sludge disposal facilities are relieved—or new facilities can be smaller.

EFFICIENT OPERATION. With Rex Float-Treat Thickeners, millions of tiny air bubbles float solids to the tank surface, forming a highly concentrated sludge blanket. Skimmers move the thickened sludge to the end of the tank for disposal.

The Rex Float-Treat employs many unique features, including: thorough blending of an air-charged stream and raw sludge feed; positive distribution of solids-flow into the tank; two zones within the tank for more efficient flotation separation and sludge concentration; and generous sludge removal capacity. Air flotation thickeners with Rex Float-Treat permit classification into floatable organic solids and settleable inorganic solids.

For complete information, write CHAIN Belt Company, 4610 W. Greenfield Ave., Milwaukee 1, Wis.

REX®
CHAIN BELT COMPANY

Rex Float-Treat Thickeners, Bay Park Sewage Treatment Plant, Nassau County, Long Island. Consulting Engineers, Greeley and Hansen. Plant Superintendent, August Zoeller.

SPARLING FLOW INDICATOR-TOTALIZER-RECORDERS

NEW—inside and out—Sparling flow recording instruments reflect the ultimate in modern engineering and design. Improved construction features assure unfailing accuracy and performance in providing instantaneous and permanent flow information. Smart new styling enhances the appearance of every installation. The "new look" includes a complete line of Indicating-Totalizing-Recording instruments to meet the requirements of any metering system with individual, remote or centralized instrumentation. *Ask your local Sparling field engineer about Sparling instruments.* Let him describe their functions; the wide range of application they offer; and how they can help increase your operating efficiency. Your Sparling representative is a metering specialist, and is available to you for assistance at any time. *Write for Sparling Equipment Bulletin 315.*

SPARLING
WATER CONTROL EQUIPMENT

HERSEY-SPARLING
METER COMPANY
Sparling Equipment: **EL MONTE, CALIF.**
225 North Temple City Blvd.

Branches: Atlanta • Chicago • Cleveland • Dallas • Denver • Kansas City, Mo. • Roselle, N. J. • San Francisco • Seattle • United Kingdom Affiliate: TYLORS OF LONDON LTD.

STEP UP

Gas Production

with P.F.T. . . . Pearth

In the heart of one of Pennsylvania's most beautiful resort areas is the thriving community of Stroudsburg. Its sparkling streams and invigorating mountain air have not only made this an attractive residential area but inviting to industry as well.

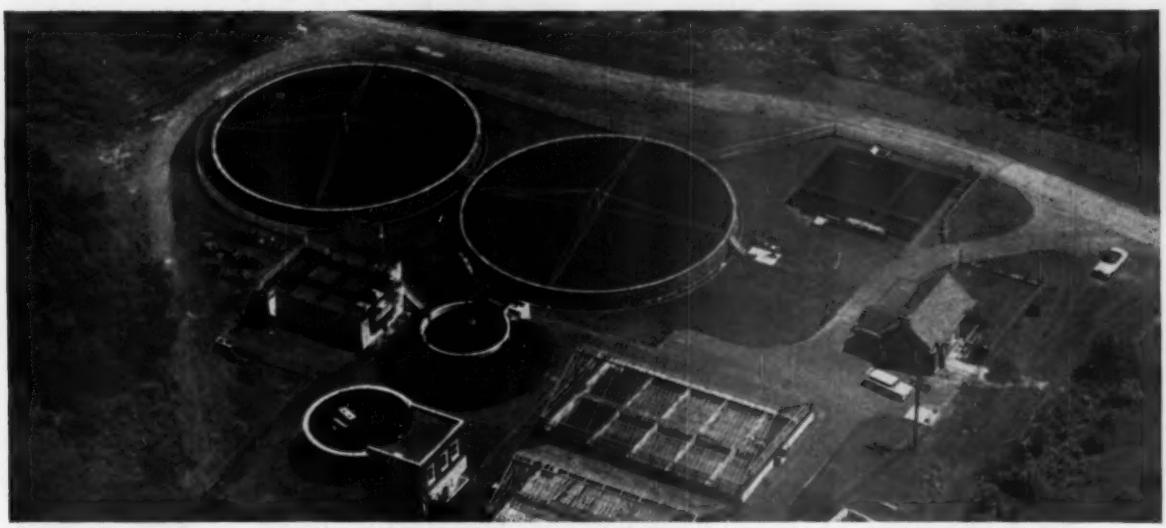
As in over 200 other communities in the United States, Stroudsburg's sewage treatment plant is enhanced by the benefits of a P.F.T.-Pearth Gas Recirculation System.

P.F.T.-Pearth steps up gas production, eliminates scum and increases digester capacity. Compressed digester gas is injected through properly spaced discharge wells into the zone below the scum layer. Violent agitation disperses the scum and effects intimate mixing of the scum and raw solids with the seed material in the active digestion zone. This steps up digestion of all solids.

There are no moving parts in the digester and no restrictions in the open end gas discharge piping. There is no danger of mechanical failure or clogging with this trouble-free system.

Other P.F.T. equipment at Stroudsburg includes: 1 P.F.T. 30′ Floating Cover, 1 P.F.T. 35′ Floating Cover with P.F.T.-Pearth installed in 1954. 1 P.F.T. #250 Heater & Heat Exchanger Unit, P.F.T. Supernatant Selector and Gauge and P.F.T. Gas Safety Equipment.

Plant designed by Albright & Friel, Consulting Engineers, Philadelphia.



Aerial Photos Shows Stroudsburg Plant with P.F.T. Floating Cover with Pearth in Foreground.

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 RAVENSWOOD AVENUE, CHICAGO 13, ILLINOIS

PORT CHESTER, N.Y. • SAN MATEO, CALIF. • CHARLOTTE, N.C. • JACKSONVILLE • DENVER

EDDY New Improved Products Meet Modern Needs

EDDY Fire Hydrant

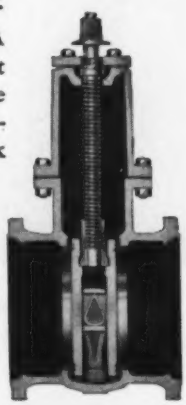
- Improved, streamlined, modernized
- Optional break-flange
- Large diameter barrel
- New self-sealing main valve packing
- Requires no lubrication
- Opens *with* pressure
- Closes *against* pressure
- Underwriters' listed
- Standardized, interchangeable parts

EDDY Check Valves

Completely new designs of horizontal swing check valves are available in sizes from 4 through 12 inches. They operate dependably in either vertical or horizontal positions and incorporate construction features which provide unusual flexibility of operation. These valves may be converted in the field from plain to single- or double-lever operation to meet changing requirements. Other check valves up to 24 inches.

EDDY Gate Valves

In addition to the regular line of EDDY Taper Seat AWWA gate valves, EDDY now offers a newly designed parallel seat AWWA gate valve in sizes through 12 inches. This valve has been specifically engineered to provide long, trouble-free service. Working parts are designed with heavy, thick section and large seating surfaces for dependable operation and improved wearing qualities. The valve has two-point, free-floating wedging for minimum friction and maximum operating ease. Other AWWA gate valves are available through 48 inches.



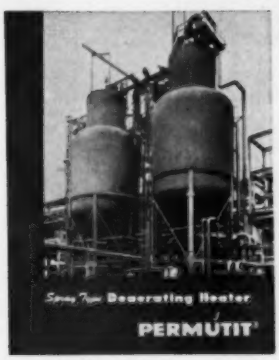
Whatever your waterworks requirements, it will pay you to have full information on the complete EDDY *line of valves and hydrants.*

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.
WATERFORD NEW YORK

Build your FLUIDICS* library

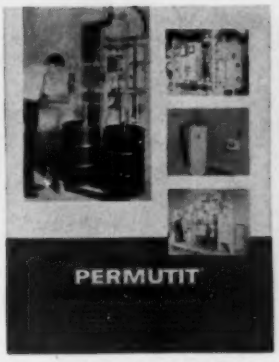
Automatic valveless gravity filter: Costs up to 45% less than conventional filters. Also saves money after installation, because it operates automatically without a single valve, agitator, pump, flow controller, or even an attendant operator. **Bulletin 4351.**

Permutit® Precipitator: Saves about 50% in ground space, 50%-75% in time of treatment, and 10%-40% in certain chemicals and adsorbents, compared to conventional reaction and settling tank. Complete facts on operation and application. **Bulletin 2204C.**

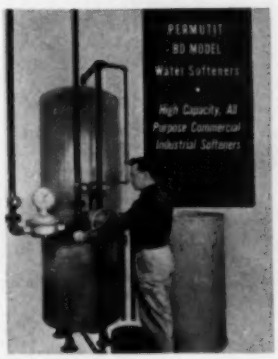


Deaerating Heaters: Designed for removal of carbon dioxide and oxygen from boiler feedwater. Permutit offers both Spray Deaerators, **Bulletin 2357** and Tray Deaerators, **Bulletin 4732.**

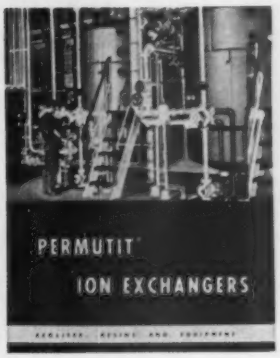
Water treatment chemicals: Permutit offers an extensive line of specialized chemicals. Typical data available: **Bulletin CS-105** on Wisprofloc-20 Coagulant Aid, **Bulletin CS-111** on Neutralizing Amines, **Bulletin CS-110** on the Permutit Briquet System.



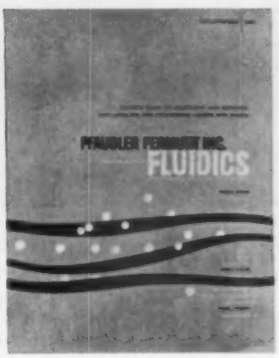
Standard packaged demineralizers: Factory-assembled, systems ready to connect and operate. For summary of applications, plus data on mixed-bed, two-step, non-regenerable and skid-mounted units, send for **Bulletin 4721.**



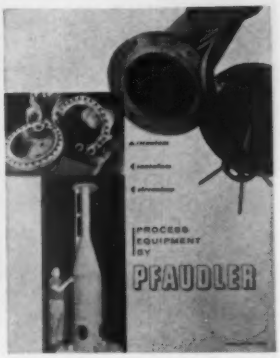
High-capacity water softening: New Permutit® Model BD Softeners answer need for more soft water at lower cost. Details on operation, specifications and performance are in **Bulletin 4696.** Industrial water softening with Permutit automatic equipment, Multiport Valve,® cation exchange, (zeolite) sodium cycle, systems and operation is described in **Bulletin 2386.**



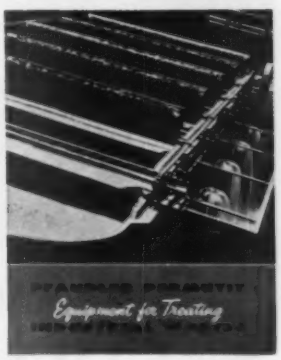
Ion exchangers: From Permutit—the only company to manufacture ion exchange resins and the equipment in which they are used—you can get a brief manual on use of ion exchange as a unit process for purification, recovery, addition, separation, concentration. **Bulletin 2508** covers Permutit resins and equipment.



How FLUIDICS works for you: Buyer's Guide surveys equipment for water and waste treatment, ion exchange, gas analysis, metering and control. Also equipment for handling corrosives, heat transfer, reactions, centrifuging and packaging. Send for **Bulletin 992.**



"New" metals for processing: Tantalum, titanium and zirconium are finding increased use, because of their exceptional corrosion resistance and strength. Corrosion, heat transfer and general application data on these metals, plus equipment available, are discussed in **Bulletin 978.**



Treating industrial wastes: Bulletin 4486 discusses types of industrial waste problems, equipment used, typical waste treatment systems.

*FLUIDICS is the Pfaudler Permutit program that integrates knowledge, equipment and experience in solving problems involving fluids.

PFAUDLER PERMUTIT INC.

Permutit Div., Dept. WS-31, 50 W. 44th Street, New York 36, N.Y.

Please send me the following bulletins:

- ☐ 4696 Permutit BD Model Softener
- ☐ 2386 Zeolite Water Softeners
- ☐ 4721 Permutit Packaged Demineralizers
- ☐ 4351 Permutit Automatic Valveless Gravity Filter
- ☐ 2508 Permutit Ion Exchangers
- ☐ 2204C Permutit® Precipitator
- ☐ CS-105 Permutit Wisprofloc-20 Coagulant Aid
- ☐ CS-111 Permutit Neutralizing Amines
- ☐ CS-110 Permutit Briquet System
- ☐ 978 Process Equipment by Pfaudler
- ☐ 992 FLUIDICS Buyer's Guide
- ☐ 4486 Equipment for Treating Industrial Wastes
- ☐ 2357 Permutit Spray Deaerators
- ☐ 4732 Permutit Tray Deaerators

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

OLD FIRE HYDRANTS

STILL DOING 24-HOUR DUTY

IN CAMDEN, N.J.

The Camden, N.J., Water Department was formed in 1845, when James K. Polk was president. A small building was erected at the foot of Cooper Street to house the pumping station. Water mains were installed and approximately 15 years later, R. D. Wood Hydrants were tied in. Since those days Camden has grown from a community of 6500 people to a modern industrial city of 125,000. All utilities have been changed beyond recognition . . . except for a number of the original R. D. Wood Hydrants that are still in service. Conditions have changed, but the reliability built into those hydrants makes them just as effective now as they were over 100 years ago.

Like all R. D. Wood Hydrants, the oldtimers are of simple but sound construction; their operation cannot be impaired by foul weather, snow, sleet, ice or silt. Apart from the hazard of being in the path of a truck out of control or the possibility of street relocations, there is no foreseeable trouble ahead for them for many more years. There has never been better fire protection for any community than R. D. Wood Hydrants.

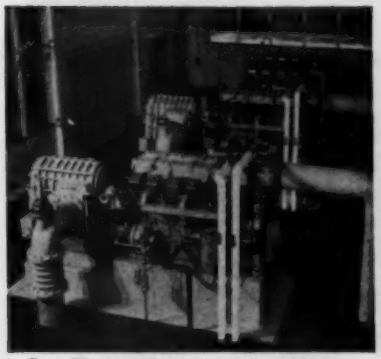
Conform to A.W.W.A. specifications

R. D. WOOD COMPANY

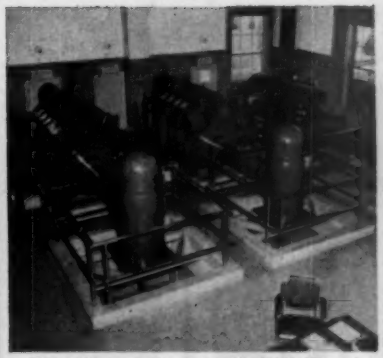
Public Ledger Bldg.
Independence Square
Philadelphia 5, Pa.

Established in 1803

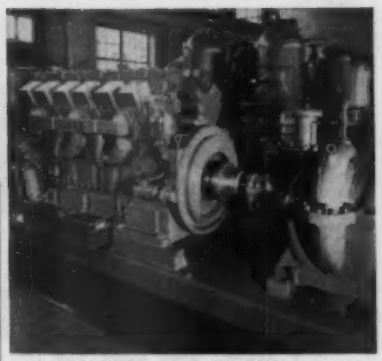
Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds)



Four Climax sewage gas engines powering blowers and pumps in a Michigan sewage treatment plant.



Three Climax engines, one Model K-67, and two V-85's driving vertical sewage pumps through right angle gears.



Model V-12 Climax engine in high capacity centrifugal pump service in a city water plant.

CLIMAX POWER

for dependable municipal plant service

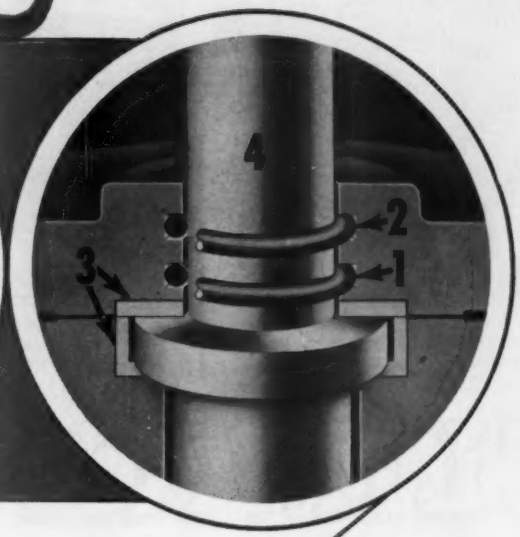
Climax engines provide excellent low cost power for sewage and water treatment plants. These rugged, simply designed engines are engineered to give quick acceleration, withstand overloading, and perform longer with less maintenance.

natural or sewage gas
LP gas • gasoline
60 to 600 max. hp.

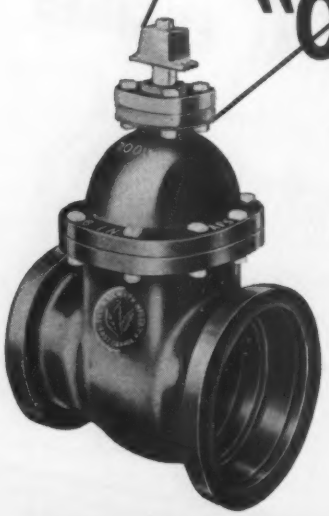
CLIMAX
engine manufacturing company
DIVISION OF
WAUKESHA motor company
Factory—Clinton, Iowa

send for **BULLETIN SA-631**

DOUBLE SEALING



SMITH VALVES WITH "O" RING SEALS



"O" Rings, due to their simplicity and reliability have been used for many years in military and industrial products. Smith non-rising stem valves are available with *double* "O" Ring seals. The lower "O" Ring (1) seals the internal pressure, while the upper "O" Ring (2) is a combined external dirt and reserve pressure seal. This construction eliminates packing, gland adjustment, and conventional stuffing box. All Smith AWWA specification valves are equipped with stem (thrust) collar bushings (3) and extra large, high strength bronze stems (4). These and other well known Smith superior design features assure positive operation, long service life, and minimum maintenance.

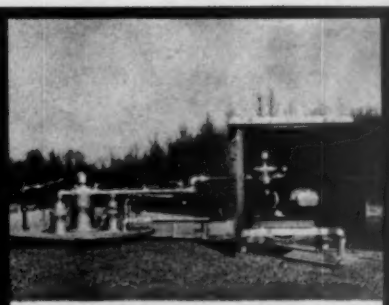
60

FIRE HYDRANTS · VALVES · SINCE 1896

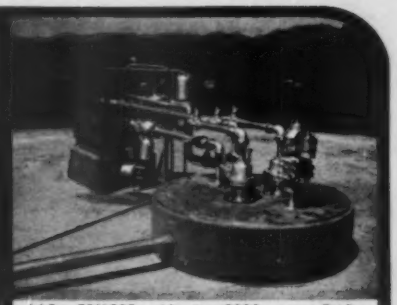
THE A.P. SMITH MFG. CO.

EAST ORANGE . NEW JERSEY

ROCKFORD, ILL.—Three GASLIFTERS in existing digesters. Henry Riedesel, Mgr., San. Dist. Greeley and Hansen, Chicago, Cons. Engrs.



GREENSBORO, N. C.—GASLIFTER in existing 75' dia. digester with floating cover. Dan Holder, Supt. City of Greensboro, Engrs.

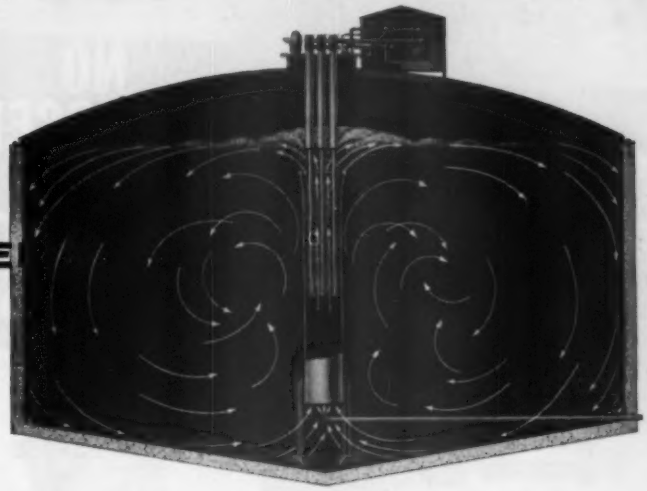


LAS CRUCES, N. M.—8000 gpm GASLIFTER in 50' dia. digester with fixed cover. R. A. Smith, Supt. Gordon Herkenhoff & Assoc., Albuquerque, Cons. Engrs.

GASLIFTER

DIGESTER CIRCULATOR - MIXE

GASLIFTER is a trademark of Walker Process Equipment Inc.



GASLIFTERS incorporate the patent right of Joseph Cunetta.

NO INACTIVE ZONES—permits utilization of entire digester capacity allowing higher loading rate.
IMPROVES OPERATION—circulates and mixes digester contents and insures uniform distribution of raw and seeded sludge.
CONTROLS START-UP—avoids start-up troubles by completely homogenizing contents; induces rapid gasification and volatile acids remain low.
ELIMINATES SCUM BLANKET AND GRIT SHOALS—circulation velocity at roof, sides and floor disperses grease blanket and bottom shoals.
EASY INSPECTION—exclusive locking chamber permits individual inspection and servicing of GASLIFTER sparging units without dangerous gas loss or digester shutdown. Eductor Tube, Gas-Lift principle avoids mechanical troubles from rag and "sewage string" fouling.

SACRAMENTO COUNTY, CALIF. (San. Dist. #3) GASLIFTER in 70' dia. digester with fixed concrete cover. Mr. Norman Farnum, Supt. Dewante & Stowell, Sacramento, Cons. Engrs.

SALT LAKE COUNTY, UTAH—(Suburban San. Dist.)—12,000 gpm GASLIFTER in 60' dia. digester. Emil Meyers, Supt. Caldwell, Richards & Sorensen, Inc., Salt Lake City, Cons. Engrs.

AURORA, ILL.—10,000 gpm GASLIFTER in existing 50' sq. digester. Williard P. Pfeiffer, Supt. W. E. Deuchler, Assoc., Inc., Aurora, Cons. Engrs.

WALKER PROCESS

WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA, ILLINOIS

NO OBSOLESCENCE WITH TRIDENT METERS

Being modern today is the continuous process of going out-of-date tomorrow. Look at the record of Trident design improvements and you'll find this statement is just as true of water meters as it is of automobiles . . . *with one exception.* ■ With Trident meters, your department is probably the only service in your community equipped with *built-in modernization* . . . a process which eliminates the high cost of obsolescence. ■ Here's how it works. ■ Every time you replace worn parts in a Trident disc meter, you automatically use *modern* parts identical to those in the *latest* model . . . parts embodying every thoroughly tested advancement known to the science of metering. Not only is repairing easy and economical, but also you actually *modernize* your Tridents as you go. ■ Take a look at the past 30 years. Think how much you're saving *this* year on Tridents installed back in 1930 . . . or even 30 years before that. ■ *All of the many design improvements now on our drawing boards continue this long standing Neptune policy.* It's your assurance that the Tridents you buy today will not be obsolete tomorrow. For personal proof, check your own records.

neptune
TRIDENT WATER METERS

NEPTUNE METER COMPANY
LIQUID METER DIVISION

47-25 34th St. Long Island City 1, N. Y. / Neptune Meters, Ltd., 1430 Lakeshore Rd., Toronto 14, Ont. / Offices in Principal Cities

Vol. 108, No. 3 • March 1961
WATER & SEWAGE WORKS
A Scranton Gillette Publication

San Diego Has Its Own Lime Recalcining Plant

by FRANK I. KOHANOWSKI
Processing Machinery
Allis Chalmers Mfg. Co.
Milwaukee, Wisconsin

EDITOR'S NOTE: The list of water softening plants practicing water softening sludge recalcining grows longer. Recently (W&SW April 1960) the Dayton, Ohio installation was described. Now Black and Associates have done it again. Sludge recalcining at San Diego's Alvarado Filtration Plant makes the City virtually self-sufficient in quicklime requirements. In addition, the aggravating sludge disposal problem has been whipped.

■ A MUNICIPALLY OWNED and operated lime sludge recalcining plant has been placed into operation by the San Diego Utilities Department. Designed by Black and Associates, Gainesville, Florida, the 25-ton-per-day plant makes the city self-sufficient in lime requirements for water treatment.

In the past, lime was bought, then lost in the sludge discarded from the settling basin. The new calcining plant, in effect, recovers all lime used in the softening process plus the additional quantity of lime obtained from calcium carbonate precipitated during treatment.

Wasting of lime is eliminated and a sludge disposal problem has been solved.

The recalcining installation, Figure 1, consists of two lime sludge storage tanks, kiln feed and building, 7 ft diameter by 100 ft long rotary kiln with integral coolers, kiln discharge and building and storage facilities or recalcined lime. All equpment except storage tanks was furnished by Allis-Chalmers.

Kiln and Feed End Building

Each of the steel storage tanks, Figure 2, contains 108,000 gallons of sludge that is pumped from the water treatment settling basins. Stored sludge is continuously agitated so that 15 to 20 per cent by weight of calcium carbonate solids will remain in suspension without settling. Each tank has a spiral stairway to a full diameter walkway which supports the agitating mechanism.

The kiln feed end building houses the service cranes, centrifuge, instrumentation, lime sludge pumps, sludge flow regulator, sludge flow meter, kiln feed screw, kiln feed end housing, motor control center for feed end building equipment and an air compressor for activating controllers and relaying information to the instruments.

Trolley wires on the kiln rotate with the kiln shell and are connected to a thermocouple projecting into the kiln. The temperature is recorded at the instrument console.

The kiln chain system begins 6 feet downhill from the feed end of the kiln shell and reduces the moisture content of the sludge feed from 35 per cent to approximately 10 per cent. The chain is suspended from steel plate spirals bolted to spiral blocks welded to the kiln shell. The chain moves through the bed of sludge as the kiln rotates and hot gases of the kiln evaporate water from sludge-coated chains.

Sludge Handling

Two pumps transfer sludge from the storage tanks to the continuous centrifugal filter. Each solids handling pump, Figure 3, has a capacity of 50 gallons per minute, operating against a total head of 92 feet. Normally, sludge is drawn from one

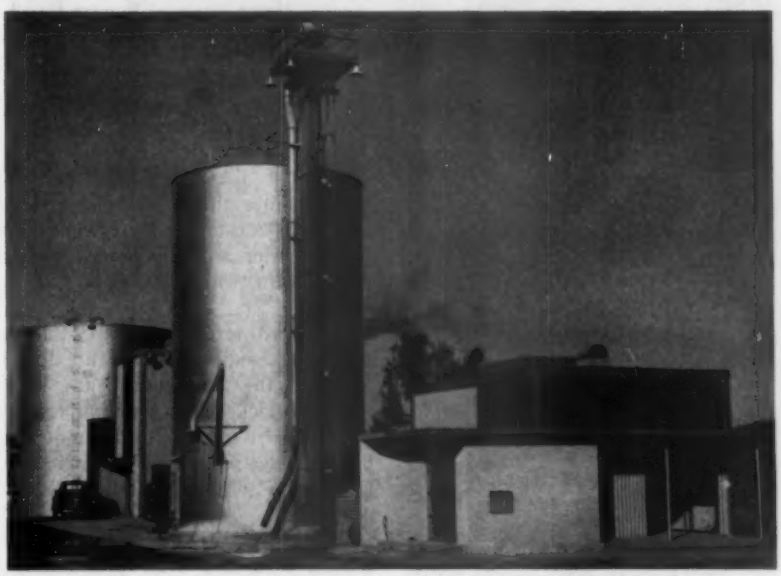


FIG. 1. INSTALLED by local contractors, overall cost of the new facility was $534,000. It eliminates waste of lime and sludge disposal problem.

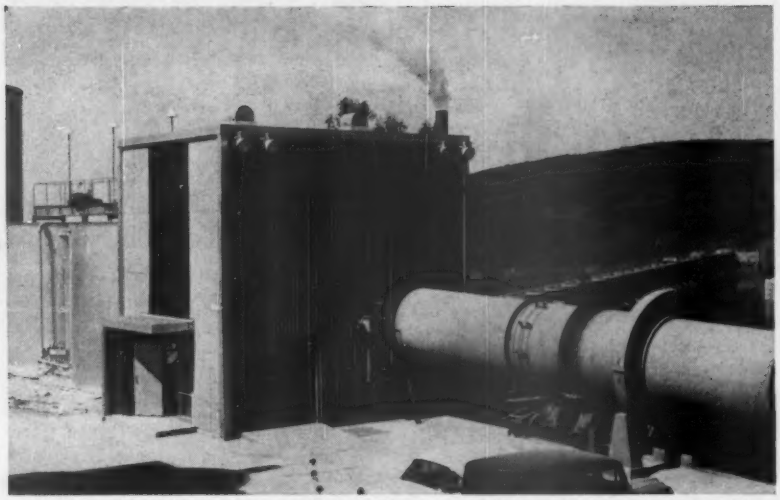


FIG. 2. HUNDRED FOOT ROTARY KILN extends into the feed end building with storage tanks located behind the same building.

tank at a time and thus only one pump is used until its tank is empty. The pumps are arranged so that either will pump sludge from either tank through a flow regulator and a flow meter, so that an accurate record can be kept of sludge flow to the filter. Provisions have been made in the piping for sampling the filter feed.

The centrifuge is mounted on vibration isolators and is capable of producing 6000 lbs of filter cake per hour containing 35 to 40 per cent moisture by weight. Feed to the filter contains 15 to 20 per cent by weight calcium carbonate sludge. The drive motor, Figure 4, is of a special design because of the rugged duty. It has thermo-guards imbedded in its stator and is controlled by a reduced voltage starter. A complete oil circulating system is provided and arranged with interlocks and a warning device so that the centrifuge cannot be started unless there is oil flow to the centrifuge bearings.

FIG. 4. CENTRIFUGE drive requires special motor design. Reduced voltage starter and stator thermo guards are used here.

FIG. 3. TWO 50 GPM sludge transfer pumps. Pumps are interconnected with both storage tanks, though sludge is normally drawn from one tank at a time.

Two hoppers are attached to the bottom of the centrifuge housing. One handles the filter cake and is flexibly connected to the flanged kiln screw feeder and the other handles the effluent which is discharged to waste.

The feed screw, Figure 5, has a water jacketed portion which extends 18" into the feed end of the kiln. A water jacket is necessary because the kiln exit gases, which are at approximately 500°F, pass around the feed screw enroute to the induced draft fan.

An exit gas temperature thermocouple, feed end draft probe, oxygen analyzer probe, and kiln exit gas duct are located on the top of the feed end housing.

Main plant motor control center is shown in Figure 6. This panel is located in the feed end building.

Gas Scrubber

Duct work transfers the gases from the feed end housing to the induced draft fan, Figure 7, which discharges through a damper into a wet gas scrubber. An air-operated butterfly valve, the damper is normally controlled from the kiln discharge end building, although manual control is possible. Adjustments are made on the damper position to provide proper draft for existing calcining conditions.

Dirt-laden kiln exit gases are wet scrubbed. They are sprayed with high pressure water jets at the bottom of the scrubber tower and the gas flow is directed toward the top through slotted trays and against other water sprays along the inside of the tower. Then the scrubbed, but moisture-laden, gases discharge at a temperature of 150°F.

Kiln Drive

The kiln drive, Figure 8, consists of a 4-speed, totally-enclosed fan-cooled, ac motor, V-belt drive, a speed reducer and pinion which meshes with the gear that is mounted

FIG. 5. BOTTOM OF CENTRIFUGE HOPPER showing kiln feed screw and kiln feed end housing. Note water jacket around screw.

FIG. 6. MOTOR CONTROL CENTER contains main circuit breaker, lighting transformer and circuit breaker, and electric motor starters for feed end equipment.

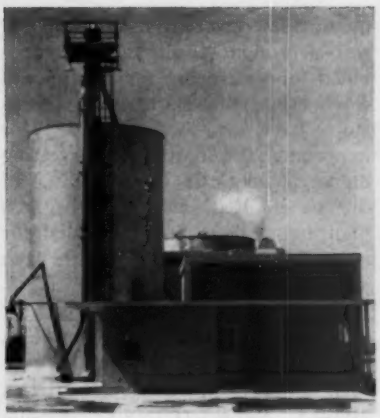


FIG. 9. KILN DISCHAGE end building and lime storage bins. Quicklime may be airlifted directly to lime feed area, or discharged through unloading pipe.

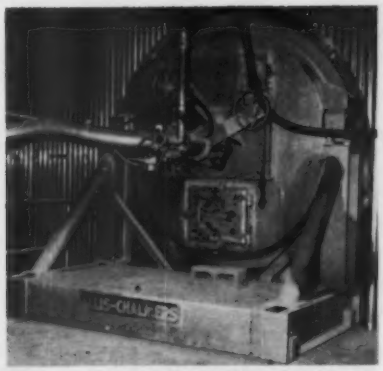


FIG. 10. ROTARY KILN firing shield, movable on wheels for adjustment and alignment.

on the circumference of the kiln shell. The main gear is enclosed by the combination lubrication housing and gear guard.

A gasoline engine is provided so that the kiln can be turned slowly in event of power failure.

Kiln speed may be varied in four steps from 0.45 rpm to 1.20 rpm; while the emergency operating speed in the event of power failure is 0.10 rpm.

Quicklime Storage

Steel lime storage bin, Figure 9, has a 400 ton storage capacity. Material discharged from the bucket elevator can go either into the bin or bypass the bin and discharge at the ground through a pipe parallel to the bucket elevator. Lime can also be removed from the bin through a discharge pipe on the side. Normal removal is by bottom discharge connected to pipes for air conveying to the water treatment area of the filtration plant.

The kiln discharge end building is located beside the product bin. This building is divided into three areas, operator's room contains a control discharge end. Air conditioned, the operator's room firing deck and kiln instrument console, motor control

FIG. 8. KILN has 4-speed electric motor drive and stand-by gasoline engine for rotation in case of power failure.

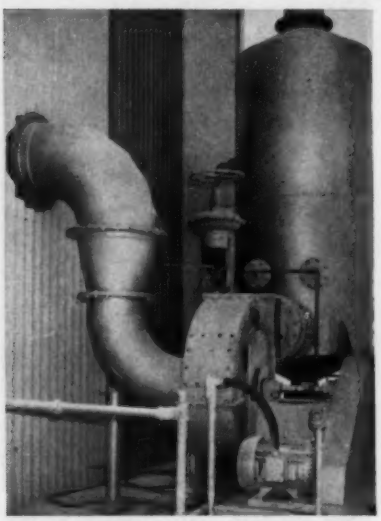


FIG. 7. KILN EXIT GAS handling equipment. Gases are wet-scrubbed and discharged at 150°F.

FIG. 11. KILN CONTROL CONSOLE instruments are air-actuated and miniaturized for this application.

FIG. 12. KILN DISCHARGE END motor control center

center, rest room and firing deck observation window. The firing floor area contains burning equipment, fuel controls and firing hood. Fuel measuring devices are located in the basement. Remainder of the building houses the end of the kiln, tube coolers, product screw conveyor and bucket elevator boot.

Kiln Control

On the burner floor at the San Diego plant, the rotary kiln firing shield, Figure 10, is mounted on wheels to facilitate adjustment and alignment to the kiln. Also, it can be pulled back for access to the kiln during shutdown and for positioning.

Attached to the firing shield are the burner and its mounting plate. Hand wheels are provided for burner adjustment. The plant is designed for a calcining temperature of approximately 2000°F with about 9,000,000 BTU's of heat required per ton of kiln product. The burner normally uses natural gas, although it has provisions for burning oil.

Air-actuated miniature instruments are used almost entirely throughout the kiln control console, Figure 11. Instruments record, indicate, and act as warning devices. Natural gas flow and pressure, kiln exit gas and chain system gas temperature, kiln discharge end and kiln feed end draft, per cent of oxygen, and lime sludge flow rate are all indicated and recorded. Lime sludge level in both tanks, as well as centrifuge drive motor amperes are indicated, but not recorded. A totalizer has been provided for measuring the natural gas flow. High temperature alarm hornstops have also been provided for important kiln locations. A rotating digit-type clock is in the center of the panel. Red, amber, and green pilot lights have been provided for indicating product level in the lime storage tank.

Motor control center, located just opposite the kiln control console is shown in Figure 12. This center contains starters for the primary air fan, product screw conveyor product bucket elevator, and for the building vent fans as well as safety devices for circuits in this area of the recalcining plant.

FIG. 13. SCREW CONVEYOR moves 150°F lime from product hopper to bucket elevator for lifting to storage bin

Product Cooling

Six tube coolers are an integral part of the kiln discharge end and rotate with the kiln. Equally spaced around the periphery of the kiln shell, the tubes have their longitudinal axis parallel to the longitudinal axis of the kiln. Lime discharges into the tubes through ports at the discharge end of the kiln shell. Here the lime is cooled and conveyed toward the kiln feed end by internal spiral flights welded to the inside of the tube coolers. Cooling is accomplished by heat transfer from hot lime to spiral to air. Induced into the tubes through the discharge openings, cooling air moves counter-flow to the lime through the spirals. Discharge openings on the uphill end of the tubes permit the lime to drop into the product hopper screw conveyor, Figure 13. The screw conveyor moves the lime from the product hopper to the bucket elevator which raises the lime to the storage bin. The temperature of the lime in this area is less than 150° F.

Figure 14 shows the valve attached to the conical bottom of the main lime storage bin. Below the valve is an air lift for conveying lime to smaller storage hoppers. From these hoppers the lime again begins its trip through the water treatment cycle.

The City of San Diego Utilities Department is directed by Mr. R. E. Graham. Alvarado Filtration Plant is under the supervision of Mr. Forrest Allison. Also actively involved with the recalcining plant are Mr. Donald Hoffman, Laboratory Superintendent, Mr. Otto Hepner, Maintenance Superintendent, and Mr. Charles Whitcomb, Assistant Mechanical Engineer.

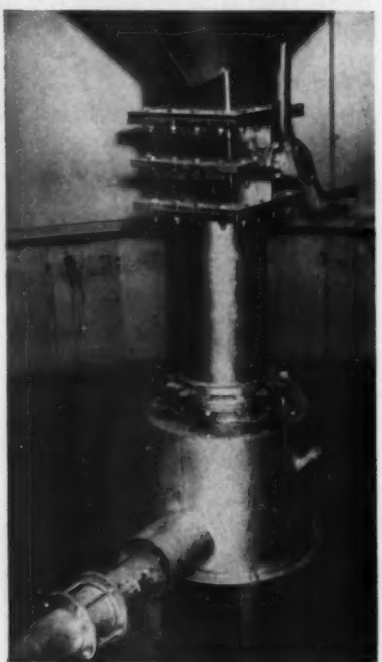


FIG. 14. VALVE at bottom of quicklime storage bin. Pipe at lower left conveys lime to water plant storage bins

The concluding article of a two-part series on . . .

Fundamentals of Sludge Digestion

Part II

Biology and Operation

by GERSON CHANIN
Chief Sanitary Chemist
East Bay Municipal Utility District
Oakland, Calif.

RESUME: To complete the coverage of this subject, this concluding article discusses first the biology of an anaerobic digester, giving particular attention to the environment needed for active, effective digestion. Such items as temperature, pH, food supply, waste products and others are discussed in regard to their effect on the process. Then this information and that presented in Part I are used as a basis to discuss the process as it takes place in a digester. Among the subjects covered are seeding supernating, feeding and heating.

■ IN THE SAME SENSE that the brewer does not actually "make" beer, or that the vintner does not actually "make" wine, or that the pharmaceutical chemist does not "produce" antibiotics, so too the sewage treatment plant operator does not really "treat" sewage. In reality sewage contains within it all of the elements necessary to "treat itself" and, as a matter of fact, sewage will treat itself whether or not it flows to a sewage treatment plant. The same may be said of sewage sludge digestion; it, too, contains within it the elements for its stabilizations; i.e., its decomposition.

A fundamental of biology is that in a given system consisting of a variety of organisms, plants and/or animals, a food which can be ingested and digested, and an environment in which the food can be utilized, a series of changes will occur which will result in a balanced ecological universe dedicated to the efficient utilization of energy from the food provided for the purpose of reproducing the various species involved. In other words, by this process called "living" a species tends to perpetuate its kind through the conversion of food materials into energy and the subsequent formation of new cell tissue.

The chemical substances which are involved in such ecological systems have been with us on this planet for a great many years. These same chemicals have been used and reused, changed and transformed, a vast number of times; but are, on the whole, from nature's original pool of chemicals, solids, liquids, and gases from which life first developed on this planet. Thus, all life is just part of a complex ever-continuing cycle of events.

Sewage treatment and sludge digestion and the industrial fermentations previously mentioned are examples of some of the innumerable systems which make up this complex cycle of life. Since sludge digestion is a living system, it can best be understood by way of the biological and biochemical explanations of what goes on in the system.

Stripped of its adornments, a digester is a miniature "universe" containing within it foods, carbon compounds, etc., and a myriad of organisms adapted to or trying to adapt themselves to a particular environment. As a result of this activity a balanced ecology will result. There will develop a variety of bacteria and other organisms to best ingest and utilize the different kinds of foods which may be present. There will develop a variety or organisms to control and regulate the system so that all the various forms of life will live and perform at the peak of their efficiency. There will develop a variety of scavenger organisms to utilize and dispose of the waste products, and of dying or dead organisms. These organisms and others will develop and form a well-balanced biological universe dedicated to the utilization of energy from the sewage sludge. This is sludge digestion.

From the standpoint of the sewage treatment plant operator, sludge is that black, smelly, difficult-to-handle conglomeration which he must tranfer from the sedimentation basins to the digesters in order to accomplish several goals:

1. To reduce the volume of the sludge.
2. To reduce the amount of organic, volatile, solids in the sludge.
3. To render the sludge less obnoxious and more readily disposable.

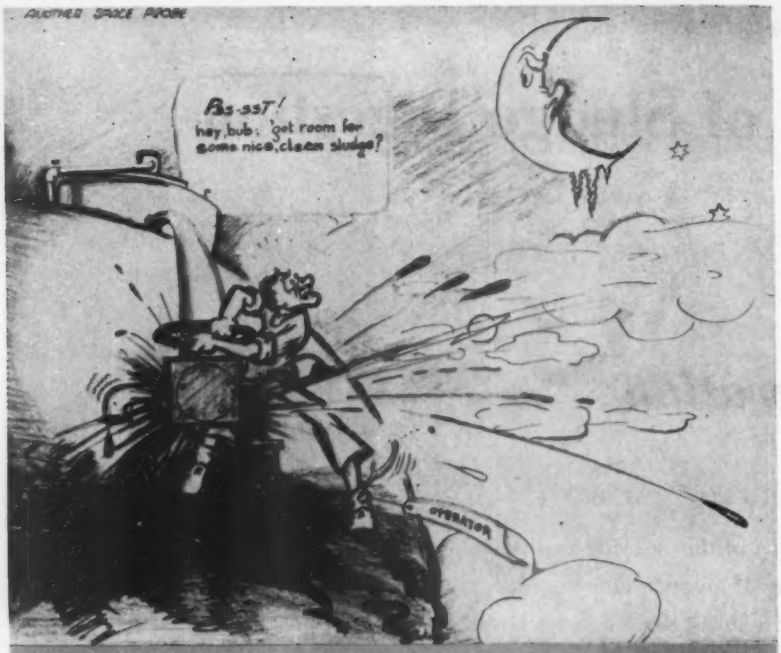


FIG. 4 A UNIVERSAL PROBLEM in sludge digester operation

4. To alter the physical state of the sludge so that the accompanying water can be readily removed.
5. To convert some of the organics into energy which he can collect and utilize.
6. All of this must be done economically and in a controllable manner.

From the biologist's or the biochemist's viewpoint, sludge is a very rich mixture consisting of a relatively large amount of organic matter, food; a large variety of organisms, both animal and vegetable; water; and miscellaneous artifacts. He recognizes that, if a suitable environment is provided, growth and reproduction and all its attending changes will occur. The problem of sludge digestion reduces to the questions: What are the desired end products and what environment will bring them about? This paper will study sludge digestion from the standpoint of the environment influences which lead to good digestion.

Biochemical Background

All sewage sludge contains within it the necessary constituents for its own decomposition. First, organic matter or food is present; this includes, starches, sugars, celluloses, proteins, fats and oils, amino acids, fatty acids, other organic acids, urea, and many others. Secondly, other necessary nutrients such as nitrogen, phosphorous, minerals, vitamins, etc., are present. Thirdly, a variety of organisms are present. While many of these organisms have not been identified and their properties are not entirely known, they are of a wide variety including many different species of bacteria, protozoa, yeasts, and molds, as well as some of the higher plant and animal forms.

It is known that the early stages in the decomposition of organic food, brought about by these organisms, proceeds along lines quite similar to those which occur in the early stages of human metabolism; hence the name "digestion" seems most appropriate. Technically, however, more than just digestion occurs in a sludge digester. In the human, digestion is the breakdown of complex foods, such as starches, poteins, and fats, into simpler compounds which are either soluble, or small enough to pass through the walls of the stomach and the intestines into the blood stream for further usage. This is where human digestion ends. The subsequent breakdown and conversion of these absorbed substances to yield even simpler compounds and energy is commonly called "burning the food" or "breaking-down process" or technically, *catabolism*. Some of the simple substances so produced recombine to form the complex chemical of cell tissue. This process is called the "building-up process" or *anabolism*. Actually, these processes go on simultaneously and the overall process is called *metabolism*. In sludge digestion both digestion and metabolism are going on.

The decomposition and utilization of carbohyrates, proteins, and fats in man is an extremely complicated process involving a great many steps; nevertheless, these steps are fairly well understood. For the purposes of this brief introduction to sludge digestion, it will suffice to outline schematically some of the reactions which could be going on in the bacterial decomposition of sludge solids. These are shown in Fig. 1, 2, and 3. Anaerobic and aerobic bacterial decomposition both begin in the same manner, but somewhat different end products are produced.

The active processes going on in digestion are probably far more complicated than those shown in these figures. Fig. 1, for example, illustrates only one of the possible pathways for the decomposition of only one of the carbohydrates. In the early stages of cellulose, another carbohydrate, the degradation would be quite different than those shown in the figure for starch. However, once the cellulose was broken down to the glucose stage, subsequent metabolism might be the same as in the case of starch. The end products of bacterial metabolism could be other than those shown and would depend upon the bacterial species involved and the environment.

The schemes presented in Figs. 2 and 3 are also only approximations of the actual processes which may be going on; these, too, will depend upon the species of organisms involved.

In all of the pathways indicated, the starting substances, the carbohydrates, fats, and proteins are very complex large organic molecules which, as the process of decomposition continues, are successively broken down into simpler and more simple compounds to finally end up as very simple chemical substances. In these processes energy is liberated.

If you burn wood or paper in a fireplace, much heat (energy) is given off, as well as carbon dioxide and

water; an ash remains. If wood or paper are decomposed according to the schemes shown, though the intermediate steps are quite different, though no fumes are evident, and though the reaction is slower, the same final end products are formed; and theoretically the same amount of energy is produced per unit weight of starting material decomposed. How is it possible to accomplish in the human body or in a bacterial cell what it takes a flame to do under usual conditions?

The secret to the phenomenon is the presence of organic catalysts called *enzymes*. A *catalyst* is a substance capable of increasing the rate of, or of starting a chemical reaction which is normally either slow or difficult to start; yet, at the same time, the catalyst is not used up in the catalyzed reaction.

Enzymes cannot initiate a reaction which is not possible chemically or physically; they can merely speed up or start a reaction. Chemically, enzymes are complex proteins capable of bringing about certain biochemical changes at normal temperatures and pressures. These enzymes, which are produced by all living cells, may act either inside the cell or outside the cell. They can be extracted from living tissue and will perform their activities even in a test tube. Yeast as purchased at the supermarket is exactly such a preparation. When added to bread dough, the enzymes in the yeast cause an alcoholic fermentation (decomposition) of some of the carbohydrate in the dough, during which gas production causes the dough to rise. Similar types of enzymatic reactions occur in a sludge digester, some taking place in the liquid itself and others taking place within the living cells present. Those enzymes which are produced in the cell and then discharged to the environment so that they act outside the cell are called *extracellular enzymes;* the others acting in the cell are called *intracellular enzymes*. Both types of enzymes are normally required. It should be remembered that, in all living tissues, decomposition and metabolism are accomplished through the activity of these biochemical catalysts. Since the extracellular enzymes are largely involved in metabolism, it may be said that in sludge digestion, digestion occurs in the liquid phase in the digester while metabolism occurs in the solid phase, the organisms which are suspended in the tank contents.

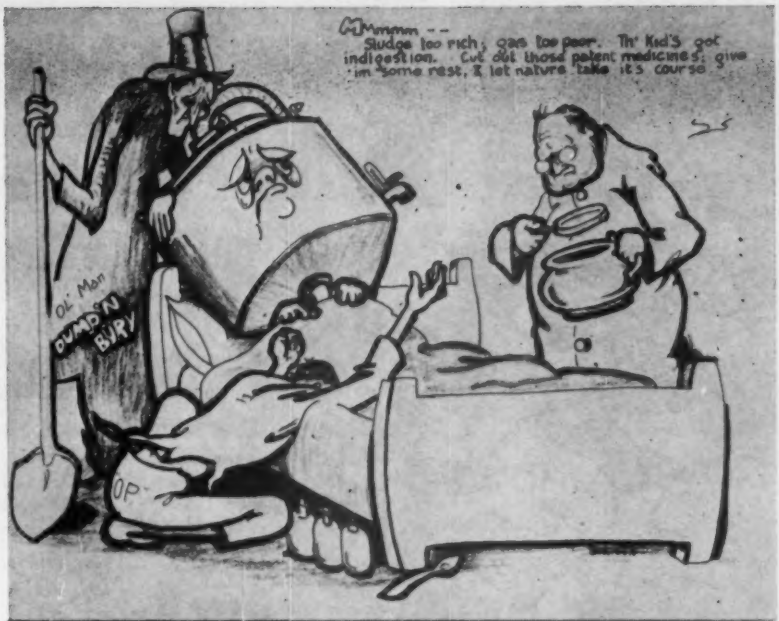

Mmmm --
Sludge too rich; gas too poor. Th' Kid'S got indigestion. Cut out those patent medicines; give 'im some rest, & let nature take its course.
Ol' Man
DUMP 'N BURY
OP

FIG. 5 THE EXPERT makes a diagnosis and prescribes a cure

In addition to these activities, organisms are also present in digesters which contain enzymes having the property of utilizing complex foods and converting them rather directly to extremely simple gases like CO_2, CH_4 and acids like acetic, butyric, and lactic. This process is called *fermentation*. Several such fermentations do go on in sludge digestion.

Enzymes are proteins; therefore, anything which can affect or react with protein will also affect enzymatic reaction. Though quite a bit is known about proteins, their structure is so complex that they have not yet been completely characterized. Nevertheless, certain properties of proteins are well known.

1. Enzymes, like other proteins, are inactivated at temperatures above 70°-80° C (158-176° F). In general, however, the rate of enzymatic reaction is directly proportional to the temperature up to the point where inactivation occurs. Inactivation of some enzymes begins at temperatures as low as 50° C 112° F).
2. The catalytic effect of a particular enzyme is generally exercised over a rather restricted range of pH. This range is not the same for all enzymes, though a great number of the enzymes are most active between pH 6-8. This is analagous to the denaturation of protein which occurs in the presence of added acid or alkali.
3. Enzymes are inhibited or destroyed by a great many substances, particularly the so-called "toxic" substances. Any chemical which is protein denaturant will adversely affect enzymatic action.

It is well known that proteins are essential to life, yet the many important roles which proteins play are not fully appreciated by the ordinary man. It is by way of a protein reaction that immunization against disease can be obtained. A minor difference in the protein material of blood makes it possible to differentiate the bloods of different species and sometimes even that of individuals of the same species. A small variation in the proteins of the blood makes certain medical diagnoses possible. Allergic reactions involve a protein reaction or alteration. The very physical and chemical nature of the living cell itself depends to a large extent upon the properties of protein. These and many other vital functions are controlled by protein in one way or another. It is small wonder, then, that enzymes possess peculiar and extremely important characteristics.

FIG. 6 PROPERLY MANAGED, a sludge digester can "go to town"

The structure of proteins, and therefore also of enzymes, is such that the surface of the molecule is covered with a great many active chemical groups which may react with a wide variety of substances. Therefore, for optimum reactivity the protein and/or enzyme environment must be carefully controlled. This control will include:

1. Providing optimum temperature
2. Providing optimum pH
3. Exclusion of inhibiting agents
4. Exclusion of toxic substances

It has been estimated that about 60 per cent of the dry weight of the cell is enzymatically active protein of thousands of different kinds. Since these enzymes are not used up in the reactions they catalyze, a relatively large amount of enzyme activity would be expected in a biological system like a sludge digester. In the organism *Escherichia coli* alone, some 50 different enzymes have been identified.

It must be concluded that these enzymes are a most important factor in sludge digestion.

Navy Uses PVC Pipe for Corrosive Soil Conditions

The West's first large-scale use of thermoplastic fittings for a water supply system is being installed at the new $100 million Lemoore Navy Air Base being constructed by the Bureau of Yards and Docks for the Bureau of Naval Weapons.

The water supply for an 800-unit Capehart family housing development will be carried from the mains to buildings in underground pipes of UPVC (unplasticized polyvinyl chloride). The fittings are also of UPVC, according to Jed Carlon, superintendent for the H. M. Robertson Co., Riverside utility contractor which is installing the water, sewerage and drainage system for this phase of construction.

The UPVC fittings, made by Tube Turns Plastics Inc., Louisville, are being used in all water service pipes under three inches. Some 10,000 fittings are required to service the Capehart units.

The Navy chose UPVC because of the corrosive nature of the San Joaquin Valley soil. Lemoore is about 40 miles south of Fresno. Some 60,000 feet of UPVC pipe is being used for the service lines of the Capehart water system.

Thermoplastic fittings, some 30,000 of them, and pipe are also being employed in installing the water system to the administrative buildings, hangars and shops at the base.

Another 1,000 units of Capehart dwellings are to be built at the base. UPVC pipe and fittings will be used in the water systems of these projects. When completed, the Air Station will employ some 5,700 military and civilian personnel with an estimated payroll of over $1 million a month.

Pasadena Water Department's 1959-60 Report

During the year 1959-60, water sales and income were off one-tenth of one per cent from last year's record high while expenses increased twelve and six-tenths per cent in Pasadena, California, according to the forty-seventh Annual Report of the Pasadena Water Department.

Water production for the year totaled 1,448,375,800 cubic feet, an increase of 19,033,600 cubic feet or 1.3 per cent above the previous year.

The number of metered services as of June 30, 1960 was 39,679; 82 more than one year ago. The gain in new metered services was 188 for the year ended June 30, 1959 and 111 for the year ended June 30, 1958. Of the total number of services, 33,172 or 83.6 per cent supplied consumers living inside the City of Pasadena and 6,507 or 16.4 per cent supplied those living outside the city.

Water sales for the year totaled $2,814,456.54, a decrease of $2,897.84 or one-tenth of one per cent below the year 1958-59. The total gross revenues for the year were $2,895,872.57 compared with $2,863,444.77 for last year, an increase of $32,427.80. There was an increase of 11.5 per cent in operating expenses compared to last year.

"HAVE to dig elsewhere for water—That looks like caprock."

Multiple purpose wrought iron pump suction manifolds are installed in . . .

Boston's Deer Island Sewage Treatment Plant

A PICTORIAL REPORT

RESUME: Use of three wrought iron manifolds in providing sewage pump suction is described. Total gravity flow to manifolds may reach 788 mgd, which will be pumped from bottom of 120′ deep caisson to the surface for treatment.

■ BOSTON's Deer Island Sewage Treatment Plant program is well under way. When completed, its 900 mgd total capacity is expected to exceed any other U.S. sewage treatment facility. Numerous design features and unique applications of engineering know-how have been included in the work now under construction.

An interesting product application involves the use of three wrought iron pump suction manifolds each placed on 10 ft dia intake shafts. Constructed of ½″ wrought iron liner plate, the manifolds are 89′6″ long x 11′ ID and will provide suction for ten variable speed pumps. The installation will handle sewage from the 10′ dia North Metropolitan Relief Tunnel and 11′ dia Boston Main Drainage Tunnel. Both tunnels run 300′ to 350′ under Boston Harbor. Flow through these tunnels is by gravity.

At Deer Island, a vertical shaft from each tunnel has been constructed, open to the atmosphere. Between the two shafts a 120′ deep concrete caisson having 105′ ID is being provided with 10′ dia reinforced concrete connections to the tunnel vertical riser shafts. These tunnel connections extend up through 27 ft of monolithic concrete enclosing the manifolds near the top with the wrought iron shaft liner connections. Sanitary and industrial waste water, and storm water will be pumped through two 5′ risers to the surface for treatment. Surging will be regulated by a network of instruments which will control the variable speed pumps by transmitting signals from the headworks of the tunnels on the mainland.

The manifolds themselves were designed to serve several important functions. Principally they offer con-

Photo Courtesy Boston Metropolitan District Commission

VIEW of 150′ dia concrete caisson showing stairway. Caisson is 120′ deep and will contain pumps for transfer sewage to surface for treatment.

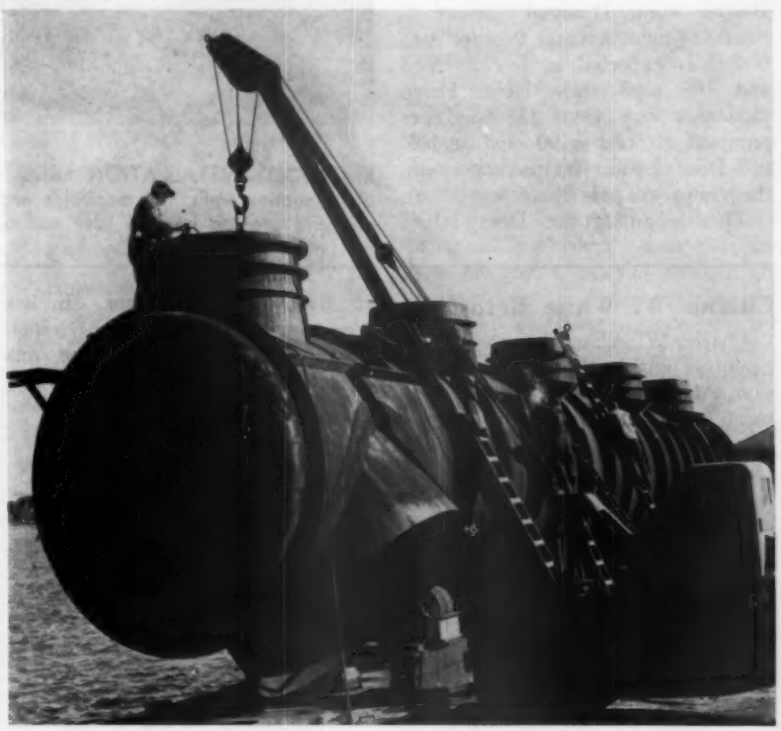


Photo Courtesy A. M. Byers Company

WORK NEARS COMPLETION on one of three wrought iron manifolds for Boston Metropolitan District Commission, Sewage Division's Deer Island Sewage Treatment Plant. Manifolds, 89′6″ long x 11′ ID, will be embedded in concrete at bottom of 120′ deep caisson.

Photo Courtesy Boston Metropolitan District Commission

ONE OF THREE manifolds starts its descent for installation in caisson's 27' thick concrete bottom. Movement of manifold to job-site required off-peak use of streets.

Sewage Treatment Plant is under the direction of F. W. Gow, Chief Engineer, and M. F. Cosgrove, Assistant Chief Engineer of the Metropolitan District Commission, Construction Division. Participating as consultants on a joint effort basis are Charles A. Maguire and Associates, Boston, Mass., Elson T. Killam Company, Short Hill, N. J., and Greeley and Hansen, Chicago, Illinois. Contractor for the pump suction system was Perini Corporation, Framingham, Mass. Manifolds were fabricated by O. G. Kelley and Company, Dorchester, Mass., from A. M. Byers Company wrought iron plate.

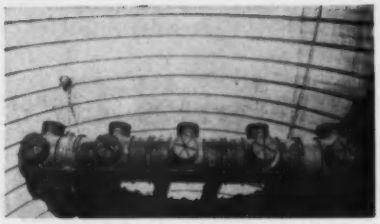


Photo Courtesy Boston Metropolitan District Commission

CENTRAL MANIFOLD well on its way toward bottom of caisson. Procedure required that holes for intake shaft (left end, bottom of manifold) could not be burned out until field pressure test had been completed. Note pump suction closure plates in place for testing.

tinuing in-place resistance against corrosion and relieve any concern for leakage through cracks which could develop in the concrete, and at the same time act as forms for the pump suction wells with integral inlet and outlet connections.

Finally, they furnish suction supply enabling flexible and efficient pump operation. Maximum design capacity of the North Metropolitan Relief Tunnel is 350 mgd while the Boston Main Drainage Tunnel is rated 438 mgd. Average flow for each tunnel is expected to be 135 mgd and 189 mgd respectively. Pump capacities vary from 135 mgd per pump at 50' tdh to 90 mgd at 105' tdh. Designed for 400 rpm maximum, the pumps will pass 6" solids.

The design of the Deer Island

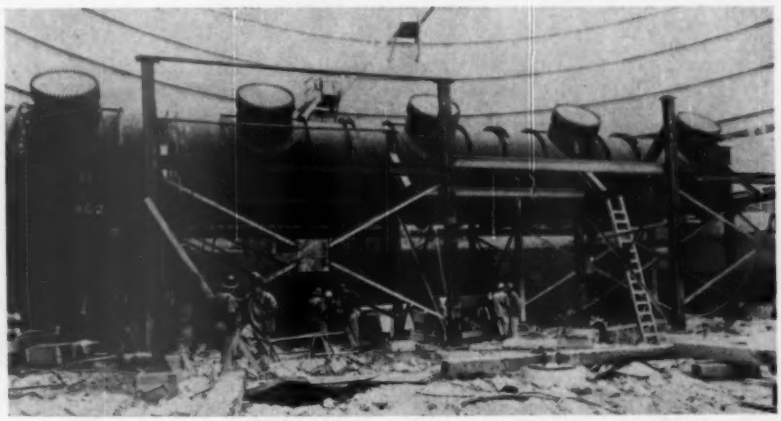


Photo Courtesy Boston Metropolitan District Commission

MANIFOLD INSTALLATION nearly complete. Used primarily as forms for pump suction wells, the manifolds provide continuing protection against leakage and provide integral inlet and outlet connection.

Charles W. White Retires

Charles W. White, Director, Water Supply Division, Bureau of Sanitation, Alabama State Health Department, retired at the close of business, December 30, 1960. He had been Director of the Division since 1946.

Mr. White was active in the formation of the Alabama-Mississippi Section of the AWWA and served as Secretary-Treasurer for several years. In 1956, the George W. Fuller Award was presented to him at the annual meeting in St. Louis. He was also active in the formation of the Alabama Water and Sewage Association and in conducting the annual Short Course School. At its last annual meeting, the AWSA made him a life member.

William H. Gilmore was named as Mr. White's successor. He has been with the Water Supply Division since 1951 and, in 1958, he was given the George W. Fuller Award.

Civil Engineering Courses Now Offered at Kellogg Campus

Applications for admittance to the new civil engineering program at the Kellogg Campus of California State Polytechnic College are now being accepted. Harold Skamser, Dean of the Engineering Division, has announced that the first two years of the four-year civil engineering curriculum leading to the Bachelor of Science degree would be offered starting in September of this year.

Included in the course offerings will be elementary surveying, engineering drafting, descriptive geometry, statically interminate structures, structural highway engineering, hydraulics, hydrology and flood control and steel structures design.

In addition to the civil engineering major, the Kellogg Campus will also offer a major in office administration for the first time next year. The first three years of this program, which also leads to the Bachelor of Science degree, will be offered starting in September, according to Dr. Robert L. Maurer, Acting Dean of the Arts and Sciences Division.

Included in the program offerings will be studies in calculating machines, principles of accounting, data processing, credit management, and purchasing and inventory control.

RESEARCH PROGRESS REPORT

Investigations of long term BOD studies show advantages of . . .

Nitrate as the Nitrogen Source in BOD Dilution Water

by PETER E. GAFFNEY and
ROBERT S. INGOLS,
Assistant Professor Applied Biology and
Professor of Applied Biology, respectively
Georgia Institute of Technology
Atlanta, Georgia

EDITOR'S NOTE: Substitution of nitrate for ammonia in BOD dilution water represents a major deviation from *Standard Methods*. These studies show an oxidation lag which is reflected in lower 5-day and even 10-day BOD values. On long term studies, however, 20-day BOD values increased as sewage volume per bottle decreased, using ammonia dilution, while nitrate dilution water minimized the BOD variations.

■ During long-term BOD studies on newly synthesized organic compounds now present in industrial wastes, it would be desirable to minimize the errors due to nitrification which may occur during and after carbonaceous oxidation. Long range BOD studies are important for such newly synthesized organic compounds as detergents.

It has been shown by Gaffney and Heukelekian[1] that sodium nitrate instead of ammonia in BOD dilution water constitutes a satisfactory nitrogen source for the growth of heterotrophic bacteria fed with sodium acetate, while the substitution of the nitrate for ammonia prevents nitrification for the full 20 days; thus allowing for direct carbonaceous BOD measurements. Although nitrate and ammonia dilution water yielded comparable 5-day BOD values for acetate, carboxymethylcellulose and oxalic acid, nitrate gave a much lower value (longer lag period) with toluene sulfonic acid.

It is the purpose of this investigation to determine the feasibility of substituting nitrate for ammonia in BOD dilution water as the recommendation in *Standard Methods* for long term BOD studies on sewage and and other groups of organic substrates.

Procedure

As nearly as possible, tests were run according to the procedures outlined in the 11th edition of *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes.* Nitrate dilution water was prepared using an equivalent amount of nitrate-nitrogen instead of ammonia in the standard dilution water. In tests using the Warburg respirometer, the nitrogen and phosphorous concentrations were increased in order to maintain a BOD:N:P ratio of 100:5:1. Each BOD value reported represents an average of either three or five replicate tests.

Results

Sewage Analyses

It was the purpose of the initial tests with domestic sewage to illustrate the problem of nitrification in the most common substrate in this field and to show the effect of nitrate substitution and substrate dilution on the BOD values.

Three series of standard dilution bottles were set up with each nitrogen source and with 2, 4 and 6 ml

Table I
Effect of Nitrogen Source and Substrate Concentration on Oxygen Demand of Domestic Sewage
BOD, parts per million

	Days 3		5		10		20	
	NH_3	NO_3	NH_3	NO_3	NH_3	NO_3	NH_3	NO_3
2 ml	126	112	196	168	210	210	590	336
4 ml	112	—	154	161	224	224	385	288
6 ml	122	113	150	155	160	165	278	264
Avg.	120	113	170	161	198	200	414	296
Std. dev.±	10	10	22	22	41	34	152	53

of sewage per bottle. BOD values were obtained after 3, 5, 10 and 20 days incubation. The results are shown in Table I and Figure 1.

The data in Table I and Figure 1 show that there was no nitrification in either set of water blanks since there was no seed used in the blanks, but that there is nitrification in the sewage samples. The difference in the 20-day values between the different sewage concentrations with both nitrate and ammonia dilution waters decreases with increasing sample volume per bottle, or with increasing concentration of nitrogenous and organic material. With a given sample volume, the BOD results with either nitrate or ammonia were generally comparable up to and including the 10-day results, but at 20 days the effect of nitrification in the tests with ammonia was significant. With ammonia dilution water the BOD range was 278 to 590 ppm (average = 414 ± 152 ppm), while the range with nitrate was 264 to 336 ppm (average = 296 ± 53 ppm). There was probably some nitrification in the tests using nitrate dilution water because of the ammonia in the sewage. Although the standard deviation was large (18 per cent), the use of nitrate dilution water results in a more realistic 20-day BOD average from all three sewage concentrations.

Other Organic Substrates

The question arose as to what effect nitrate dilution water would have on the BOD of a mixed nitrogenous-carbonaceous substrate. In order to determine this, a test was run using 3.0 and 6.0 ppm glucose-glutamic acid mixtures in standard and nitrate modified dilution water. The results are shown in Table II and Figure 2.

It can be seen from Table II and Figure 2 that comparable BOD values were obtained with either nitrogen source up to a period of 7 days.

Table II
Effect of Nitrogen Source on Oxygen Demand of 3.0 and 6.0 ppm Glucose-Glutamic Acid Mixtures
BOD, parts per million

Days	3.0 PPM mixture NH_3	3.0 PPM mixture NO_3	6.0 PPM mixture NH_3	6.0 PPM mixture NO_3
2	1.1	1.1	2.1	2.3
3	1.2	1.2	2.4	2.5
5	1.0	1.1	2.4	2.6
7	1.2	1.2	2.6	2.8

The next step in the investigation was to determine the availability of nitrate nitrogen in tests with other organic substrates and to determine the feasibility of its use in order to prevent nitrification during long-term BOD measurements. The substrates employed for standard-dilution tests were glutamic acid, starch, sodium formate, glucose and sodium acetate. The results of all these tests are presented in Table III while the BOD curves with only acetate are shown in Figure 3.

It can be seen from these data that in the early oxidation phase (3—5 days) longer lag periods were obtained in the nitrate tests with glucose, acetate, and formate but that the effect of this longer lag was overcome by the 10th day. Conversely, with glutamate and starch, the BOD values with nitrate were slightly higher up to and including the 5th day, although some of this difference may have been caused by the normal variation in experimental technique.

The data in Table III are especially interesting from the standpoint of the decrease in BOD between the 10th and 20th day for all of the strictly carbonaceous substrates that were tested with standard dilution water containing ammonia as the nitrogen source. The values given in the table are corrected BOD's obtained by subtracting the oxygen demand of the sewage seeded blanks from the total oxygen demand in the test bottles. The curves in Figure 3 serve to illustrate the reason for this decrease in BOD. The oxygen demand of the seeded blanks with ammonia dilution water increased from 0.4 to 2.8 ppm between the 10th and 20th day due to nitrification. This means that 2.4 ppm oxygen was used in the oxidation of ammonia. The simultaneous increase in oxygen demand in the sample bottles with acetate was only 1.8 ppm indicating that there was less nitrification in the sample bottles than was observed in the seeded blank. The slopes of the two curves between the 10th and 20th day are different, and it therefore is not a reliable procedure to make BOD corrections on this basis. This error was not obtained where nitrate was substituted in the dilution water since there was no nitrification.

Table III
Effect of Nitrogen Source on Oxygen Demand of Several Pure Organic Compounds
BOD, parts per million

	Days 3		5		10		20	
	NH_3	NO_3	NH_3	NO_3	NH_3	NO_3	NH_3	NO_3
Glutamate (5.4 ppm)	2.3	2.5	2.8	3.3	3.3	3.3	3.7	4.0
Starch (5.8 ppm)	2.2	2.4	2.6	2.8	2.9	2.8	1.9	3.2
Glucose (6.0 ppm)	2.8	0	2.9	2.2	3.1	2.6	2.4	3.1
Formate (40 ppm)	0.4	0.3	2.0	0.6	5.4	5.4	4.8	5.4
Acetate (20 ppm)	5.5	0.2	5.8	5.5	6.2	5.4	5.2	5.8
Seed Blanks	0	0	0	0.1	0.4	0.3	2.8	0.3

Nor was the decrease in the calculated BOD between the 10th and 20th days observed with sewage because the blanks, which in this case were not seeded, developed no demand from nitrification. The slopes of the blank and substrate curves with nitrate dilution water were almost the same, so there was no decrease in calculated BOD with sewage seed correction.

Since it had previously been reported[1] that nitrate and ammonia dilution water yielded comparable 5-day BOD's with several compounds, it was pertinent to determine the effect which the contribution of oxygen from nitrate had in lowering 5-day BOD values with glucose. Consequently, another test was run using glucose with five replicates each to compare the 5-day values obtained with nitrate and ammonia dilution water. The results of these tests are presented in Table IV.

Table IV
Effect of Nitrogen Source on 5-Day BOD of Glucose

	5-day BOD, (pts./pt*)	
	NH_3	NO_3
Min.	0.43	0.40
Max.	0.49	0.49
Avg.	0.46	0.45
Std. dev.	±0.04	±0.05

*parts O_2 per part glucose

These data show no difference in the extent of BOD in ammonia or nitrate dilution waters.

Similar tests were run with five different industrial waste samples and the results are presented in Table V.

Table V
Effect of Nitrogen Source on 5-Day BOD of Several Industrial Wastes

		5-day BOD (parts per million)	
Waste	N-Content	NH_3	NO_3
White Water	Deficient	1420	1480
Photographic	Unknown	34	36
Organic dye (1)	NH_3 excess	195	191
Organic dye (2)	NH_3 "	229	199
Organic dye (3)	NH_3 "	205	207

It may be seen from the foregoing results that the 5-day BOD with nitrate was not significantly lower than that obtained using standard dilution water provided that the lag period with nitrate was not excessive.

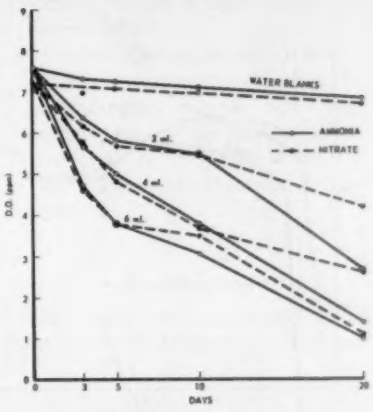


Fig. 1. OXYGEN DEPLETION in bottles using 2, 4, and 6 ml domestic sewage with nitrate and ammonia dilution water.

Discussion

The extent to which nitrification constitutes a problem or interference in BOD tests with various substrates depends on the following factors: nature and concentration of organic substrate (carbonaceous or nitrogenous), duration of test or period of incubation, the use of seeded or unseeded blanks, the number of nitrifiers in the sample and/or seed, the availability of ammonia and carbon dioxide, and the oxygen tension. When pure carbonaceous organic compounds are studied in the BOD test, some nitrogen compound is consumed; therefore, less ammonia will be left for nitrification. This was observed in Table III with acetate. Conversely, nitrogenous organic compounds such as amino-acids will liberate ammonia by deamination and may contribute to a larger oxygen demand from nitrification. The duration of the test and the number of nitrifiers are interrelated: Heukelekian[2] has shown that sufficient seed nitrification may begin immediately, while with a limited seed nitrification may be delayed. Thus, the longer the necessary incubation period for studying a new organic substrate, the more likely the onset of nitrification and the less chance of obtaining a truly carbonaceous oxygen demand. When the dissolved oxygen in a bottle is almost completely consumed by the carbonaceous demand, nitrification may be retarded by the low oxygen tension as shown by Ingols[3]. In order for the oxygen to be used, ammonia and carbon dioxide must be present. Possibly the higher rate of nitrification frequently observed in the later days of long-term BOD studies was a result of the improved carbon dioxide tension after carbonaceous oxidation.

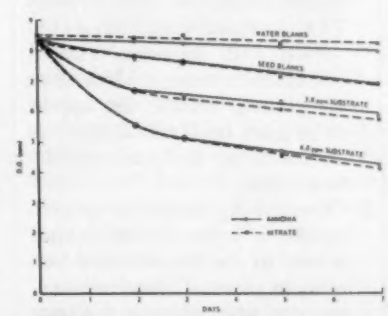


Fig. 2. DEOXYGENATION of glucose-glutamic acid mixtures using nitrate and ammonia dilution water.

In the calculation of BOD values, a special problem arises when seeded blanks are used as controls and the oxygen demand in the blanks is subtracted from the total oxygen demand in the test bottles in order to obtain the differential BOD of the substrate. *Standard Methods* calls attention to this fact and recommends even for standard 5-day tests the use of an actual BOD determination on the sewage seed for calculating the dissolved oxygen in the blank. Thus an amount of BOD proportionate to the volume of seed in the test bottles is subtracted from the total sample BOD. In the very dilute seeded blanks (0.1—0.3 per cent by volume) there is very little heterotrophic bacterial competition for ammonia and/or oxygen; thus, the seeded blank frequently manifests an earlier nitrification than a sewage sample at 2 per cent concentration.

Data obtained in these studies substantiate the favorability of calculated blank procedure even as far as the 5-day BOD is concerned. However, after the 10th day of incubation it is obvious that the calculated blank value to be used in calculating the sample BOD will be affected by the sewage concentration employed in the bottle. Thus, the BOD with the lower sewage concentration (2.0 ml per bottle) is greater than twice that observed with three times that concentration. It has been shown that during the 20-day BOD studies, the wide range in values may be minimized to give a more realistic carbonaceous BOD with smaller average deviation

by substituting nitrate in place of ammonia in the dilution water. In addition to this, the use of nitrate dilution water eliminates the difficulty of interpreting decreasing BOD values between the 10th and the 20th day during oxidation of pure carbonaceous organic compounds where seeded blanks are used with ammonia dilution water. The discrepancy between the extent of nitrification in blanks and sample bottles is eliminated by the presence of nitrates or the absence of nitrification (except for a small amount of nitrification from the ammonia content of the seed).

Although no Warburg analytical data have been presented in this report, it is noteworthy to mention that the authors have never observed anything approaching the theoretical amount of nitrification in Warburg tests using standard dilution water. In the previous article[1] it was concluded that nitrification could be prevented by limiting the amount of ammonia-nitrogen available for carbonaceous oxidation through the use of a BOD:N ratio of 100:5. From more recent analyses and the fact that it appears improbable that the heterotrophic bacteria will consume that much nitrogen, it is considered pertinent to reconsider other possible limiting factors; i.e., the carbon dioxide supply. In order to measure the oxygen uptake directly by the Warburg technique, it is necessary to trap the carbon dioxide produced. It is considered probable that this absence of carbon dioxide from the gaseous phase may be the major limiting factor for nitrification rather than the limited ammonia nitrogen and/or oxygen supply.

The authors also believe that the carbon dioxide requirement for heterotrophic bacteria has not generally been considered as a limiting factor in Warburg BOD determinations or in standard dilution tests. It is probable that the lag periods observed in these tests using high substrate concentrations and very dilute seed may actually be a manifestation of the heterotrophic bacterial requirement for carbon dioxide as a precursor for an important intermediate in the oxidative pathways of the citric acid cycle in the bacteria. Studies that are in progress at the present time dealing with the carbon dioxide requirements for nitrifying bacteria in BOD tests and for eliminating lag periods in both heterotrophic oxidation during BOD tests as well as in waste treatment processes will be the subject of future articles.

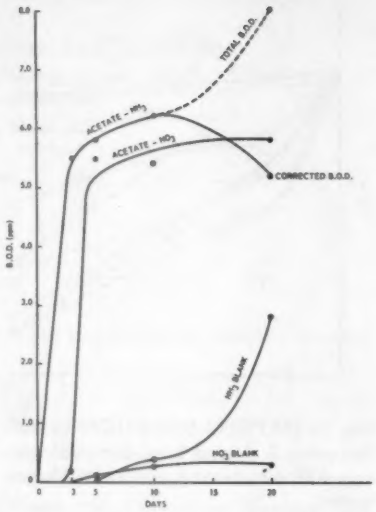


Fig. 3. OXYGEN DEMAND of Sodium Acetate using nitrate and ammonia dilution water.

Conclusions

The investigations were designed to determine the feasibility of substituting nitrate in place of ammonia in the dilution water used for BOD studies on sewage, industrial wastes, and single organic substrates. On the basis of the data obtained it may be concluded that:

1. Nitrate constitutes a satisfactory nitrogen source for the bacterial oxidation of all the substrates studied although it may not, in certain cases, be as readily available as ammonia in the early oxidation phase. The resultant lag in oxidation with nitrate dilution water may yield lower 5-day or even 10-day BOD values than those observed with ammonia (standard dilution water). With some compounds, nitrate did appear to be more readily available than ammonia in the early oxidation phase.
2. Once the lag period in oxygen-uptake is over, nitrate oxygen is used by the heterotrophic bacteria in place of dissolved oxygen gas when there is a nitrate nitrogen demand, and thus the observed BOD tends to be lowered. However, the data indicate that this decrease in observed BOD is too slight to warrant any considerable attention since the advantages far outweigh these disadvantages in certain cases.
3. The advantages of using nitrate in BOD dilution water are threefold with respect to long-term BOD studies.
   (a) In BOD tests on sewage using ammonia the 20-day BOD values increased from 278 to 590 ppm as the sewage volume per bottle decreased from 6.0 to 2.0 ml. Substitution of nitrate dilution water minimized these BOD variations and yielded an overall average in substantial agreement with the highest sewage concentration in ammonia dilution water (where oxygen tension was lacking for extensive nitrification and where the nitrification of any ammonia in the dilution water was multiplied by a smaller dilution factor).
   (b) Tests on pure organic substrates require artificial seeding and it is necessary to include seeded blanks. When the amount of nitrification in these blanks exceeds that observed in the sample bottles where the heterotrophs have used some ammonia between 10 and 20 days, the correction for the seed results in observed decreasing BOD values. Since there is only slight nitrification in the seeded nitrate dilution water (due to the ammonia in the sewage seed), this oxygen demand of nitrification is eliminated by nitrate substitution and the BOD does not decrease.
   (c) In tests using nitrate dilution water, once carbonaceous oxidation is complete, oxygen-uptake ceases and the long term (20 day) BOD value better represents the ultimate carbonaceous BOD of any particular carbonaceous substrate.

In addition, corollary information derived from these studies has led

to the following conclusions:

4. The recommendations presented in *Standard Methods* concerning the handling of seed blanks where artificial seeding with sewage is required should be followed to minimize BOD errors. However, the procedure of running a complete BOD on the sewage seed and subtracting a proportionate amount based on seed concentration in the test bottles does not eliminate the error in 20-day values unless nitrate is used in the dilution water.
5. Further studies should be made concerning the carbon dioxide requirements for the nitrifying organisms and the heterotrophic bacteria involved in Warburg and Standard Dilution BOD tests.

Acknowledgement

This study was supported by a grant from the Division of Research Grants, National Institute of Health. U. S. Public Health Service.

References

1. Gaffney, P. E. and Heukelekian, H., "Oxygen Demand Measurement Errors in Pure Organic Compounds—Nitrification Studies," *Sewage and Industrial Wastes* 30, 503 (1958).
2. Heukelekian, H., "The Influence of Nitrifying Flora, Oxygen and Ammonia Supply on the Nitrification of Sewage," *Sewage Works Journal* 14, 964 (1942).
3. Ingols, R. S., "Determination of Dissolved Oxygen by the Dropping Mercury Electrode," *Sewage Works Journal* 13, 1097 (1941).

Annual Report Buffalo Sewer Authority, 1959-1960

The year 1960 marked the 25th anniversary of the creation of the Buffalo Sewer Authority by the New York State legislature in April 1935. The anniversary was noted in the 22nd Annual Report of the Buffalo Sewer Authority.

The sewage treatment plant has continued to be effective in its basic purpose of discharging only a disinfected effluent to the Niagara River. Sewage volume continued to follow the unusual low pattern of the two preceding years with the year's daily average flow of 126 million gallons equalling that of last year.

Storm water drain construction continues to be a major operation of the authority. Four projects were completed during the year at a cost of $619,805, one project was pending acceptance at $44,795 and at the year end one project was under construction and one was about to commence at total contract prices of $653,050.

Envelope, Bill Collection System

Transo Envelope Co., Chicago, Ill., recently conducted a survey indicating that for every $25,000 in gross billing, the average small business or professional man loses upwards from $490 in the form of bad debt loss.

"We are now in a poor collection era," says a Transo spokesman, "and the trend happens to be increasing —rather than decreasing—at the present time."

This problem has instigated a new four-mailing collection series, designed to collect from the slow payers quicker with a lower collection cost than usual. The new system also attempts to speed up the pre-mailing handling flow. This system is a low cost series of low pressure letters, statements and reminders.

The first of the four-piece series is a simple statement form. White in color, it provides for a description of the service or merchandise delivered, its price, and the amount due.

The second is a green "friendly reminder" note. It again states the amount due and includes the sentence, "We are sure you would like to get this unpaid bill 'off your desk' as soon as you can."

The third piece, yellow in color, holds to the courteous tone of the previous reminders, but is somewhat more forceful. It asks, "May we please hear from you soon?"

The final piece, pink in color, forcefully states, "We have extended you every opportunity to take care of this bill. Your account is now delinquent. . ." and so on.

To go with each of the above is an outgoing mailing envelope with the self-sealing adhesive and plastic address window.

Some users of the system are reporting "sharply improved" collections—some as much as one-third to one-half better than previously.

Success of the system can be attributed, to a large extent, to the fact that it makes payment easier than procrastination. The statement or reminder comes to the debtor completely pre-printed. Amount due, date, and the names and addresses of both debtor and creditor, all are clearly visible on the form. Since the statement-reminder is also a reply envelope, the debtor's one job is to enclose his check and drop it into the mailbox.

Publication Features Giant Water Filtration Plant

The recent fall-winter issue of the Alco Review, a product publication of ALCO Products, Inc., features a comprehensive article on the world's largest water filtration plant, which is now under construction at Chicago, Illinois.

The $102 million plant on the Lake Michigan waterfront is scheduled for completion in 1962, when it will begin to supply water to about 3,000,000 Chicagoans. It will have a daily rated output of 960,000,000 gallons, with the hydraulic capacity to deliver almost twice that amount if future demands should require it.

Copies of the Review may be obtained from Alco Products, Inc., P.O. Box 1065, Schnectady, New York.

Kennebec Water District's 1959 Report

The 53rd Annual Report of the Kennebec Water District for the year 1959 discloses that the total operating revenues for 1959 for the District in the State of Maine were $233,175.57, showing a net operating income for the year of $2,189.

This figure compared to a net loss for 1958 of $8,014.12 reflects the additional income from a full year of operation under a new rate schedule.

The total number of gallons of water distributed through mains totaled 2,051,298,700. The average number of gallons used per day was 5,647,394

Sewage Flow Regulators

by MAX B. PHILLIPS
Supt. of Sewage Treatment
Bryan, Ohio

■ IN THE DEVELOPMENT and extension of sewerage systems, it is and has been necessary to regulate and control flow to some portions of the systems. During storm periods or thaws, excessive flow volumes may cause considerable damage or serious inconvenience if not relieved at desirable points and times. Since many systems are extensions of original design, the problems presented are somewhat in common but may also be local in nature.

Where engineering design and study determine, some type of regulator for volume control may be used. Generally, these regulators are placed on sanitary or combined sewers, near an available outlet to a storm sewer or water course. These regulators are designed to collect the normal sewage volumes and contain some means of limiting flows that eventually reach the sewage works for treatment.

Usually, from 50 to 200 per cent over normal volumes may be admitted, and the excess bypassed or excluded to a convenient and permissable outlet. Where the sewerage system terminates in a sewage works, flows only 25 to 75 per cent over normal capacity can be treated. In the event more volume is received, it will be bypassed or only partially treated, although in many locations it may be better to control the bypass at the sewage plant than in many parts of the system, such as in parks or within congested areas.

Regulator Use

In order to obtain a broad and clear picture of the use of regulators, a questionnaire was sent to sixty Ohio villages and cities. Forty-three cooperated, so this paper could be prepared. Thirty per cent listed infiltration and storm flow a major problem; fifty-one per cent have some difficulty; and eighteen per cent have little or no trouble from storm water. Of these villages and cities, seventy-seven per cent have regulators. The numbers vary from 2 reported in Salem to the complex of 378 regulators in Cleveland.

Types of regulators used are noted as follows in decending frequency: overflow dams or weirs; flood gates; orifices; float operated gates; and leaping weirs. Malfunction is present in all types. Causes may be grease, corrosion or the inumerable objects that find their way into the sewers. Some cases were reported to be caused by poor design and adjustment. Flood gates have been a widespread problem, either by sticking open or closed.

The problem, of course, is to collect sewage flow within desirable limits and still provide a reliable means of exclusion. Regulators that permit escape of sewage into a storm sewer at other than permissible times certainly constitute a violation. So these violations may be eliminated, the regulator must be practical, efficient and require a minimum of attention. It is evident from the characteristics of sewage and industrial wastes, this a difficult matter.

Inspection and Maintenance

In the municipalities reporting, about half of the regulator systems are inspected by sewage plant personnel; the remainder by street departments or departments of public service. It is apparent that, among the villages and small to large cities, regulator inspection is within the responsibility and duties of sewage plants. In the larger cities it has been necessary to place the responsibility with the departments of public service or an allied department because of the extent of the system. Inspections have been noted on a daily, twice weekly, weekly, monthly, and quarterly basis.

It is interesting to note that only twenty per cent of the sewage plants have regulator maintenance, while eighty per cent of the maintenance work is performed by others.

In my first-hand information with the City of Bryan for the past nineteen years, regulators have been a continuous problem. In the interceptor sewer construction of 1938 and 1939, fifty orifice type intercepting manholes were constructed. Some were proposed as temporary, while others were to be permanent. Further sewer construction has eliminated only four of these regulators.

When the sewage plant was completed in January of 1940, weekly inspection of the regulators was performed by sewage plant personnel. Due to work schedules required in the plant, these duties were shifted to the Street Department in 1941. For various reasons, such inspections were returned to the sewage plant after two or three months. In the period of 1945 to 1947, there was a general breakdown of inspections and the system was neglected. However, in 1947, the sewage plant assumed such inspections and a satisfactory and efficient schedule was set up which remains to the present as a part of the sewage plant operations.

First, the necessity and requirements were presented to the governing body, so time and equipment would be provided. A report form was made up, numbering each regulator and the location. When the usual inspections are made on Monday and Friday mornings, each was noted as open or closed. By such records we have been able to determine the best size orifice for each location. At all times two men work together in this program. The date and the time of inspection is always noted, as well as by whom the work was done Since all regulators are on combine' sewers, the closures are usu lly caused from street wash or large objects that lodge in or near the orifice and then build up sludge to the point

where the mass closes the opening. Only a long pole is required to open these orifices and the sludge and accumulations is washed into the intercepting sewer.

Whenever an infrequent maintenance is required, a work request is sent to the Street Commissioner, who cooperates in cleaning and reports the materials and cost of work performed.

When pressed for time, by experience we know the regulators having strong sewage or industrial wastes and inspect these in precedence over others. It is a matter of judgment when to inspect regulators following rainfall or a thaw, and the decision may be determined by the amount of dilution available at the time.

We have a workable and agreeable program, which is continually being promoted to City Council. In general, the problem may be handled in much the same manner and as outlined as follows:

1. Provided the proper information to the governing body.
2. Determine the extent of the problem.
3. Determine the frequency of inspection.
4. Determine the responsibility for inspection and maintenance.
5. Provide the necessary tools and equipment, including record form and required safe guards.
6. Have a fairly flexible program, and make changes and adjustments where possible.
7. Submit inspection and maintenance of the regulator system as a budget item, and make frequent reports to the governing body.

Departmental friction was evident in a few cases, although this should never be permitted to approach the point where the situation will suffer. Friendly rivalry may be agreeable and can exist without damage to relations.

Regulator Administration

Sewage plant personnel should have control of the regulator system and, if this is not possible, all records of inspections and maintenance should be made available to the plant. Possibly, the extent of violations to a water course may be of little or no importance to street departments and may be beyond the knowledge of the governing body. This is a hazard to be faced and is overcome only by education and a desire of all parties to cooperate to keep violations within reasonable limits.

Actual maintenance is probably better carried out by street or allied departments, inasmuch as they have the necessary equipment and engage in this activity on a full time basis.

Records should be kept and made available in every municipality having regulators of any type, and these records should be of equal importance as the data required on the use of the sewage plant bypass as noted on the report form submitted to the State Department of Health.

It is only where complete understanding and harmony exist among departments and city officials that a satisfactory solution can be developed on this permanent and growing problem.

American Pipe Threads Standards Published

"American Standard Pipe Threads (Except Dryseal), B2.1-1960," and "American Standard Dryseal Pipe Threads, B2.2-1960," have been approved by the American Standards Association and published by The American Society of Mechanical Engineers.

The previous edition of B2.1 was approved as an American Standard by ASA in 1945. It contained standards for dryseal pressure tight joints that are now published separately as B2.2.

The standard for pipe threads (except dryseal) covers specifications, dimensions, and gauging for taper and straight pipe threads including certain applications. There are 19 tables and 6 appendixes.

The important revisions are as follows: The E_1 internal diameter and the L_1 handtight engagement values for the ⅛ and ¼ sizes for American Standard Taper Pipe Thread, NPT, have been revised to correct for a disproportionate number of threads for handtight engagement. Previously published data on ANPT pipe threads have been omitted. For information on this thread, reference should be made to Military Specification, MIL-P-7105.

The standard for dryseal pipe threads covers specifications, dimensions, and gaging for taper and straight dryseal pipe threads. There are 34 tables and 4 appendixes.

A revision of E_1 internal diameter and the L_1 handtight engagement values for the ⅛ and ¼ inch sizes has also been made to correct for a disproportionate number of threads for handtight engagement.

The basis for the development of the American Standard for pipe threads can be traced back to the 1800's and the Briggs Standard which established certain definite detail dimensions.

Under the co-sponsorship of the American Gas Association and ASME, a committee was formed in 1913 to re-edit and expand the Briggs formula. The work was completed six years later and was the first American Standard to be approved as such by the ASA. The current standards with latest revisions, B2.1 and B2.2 were approved by ASA on April 29 and August 1, 1960, respectively.

Copies of American Standard Pipe Threads (Except Dryseal) B2.1-1960, and American Standard Dryseal Pipe Threads B2.2-1960, are available at $3 for the former and $3.50 for the latter from the American Standards Association, Dept. PR 186, 10 East 40th Street, New York 16, N. Y., and The American Society of Mechanical Engineers, 20 W. 39th Street, New York 18, N. Y.

Water Research Symposium

Plans have been made for the Water Research Symposium, sponsored by the National Reclamation Association and the National Association of Soil Conservation Districts, to be held at the Sheraton Park Hotel in Washington, D. C., March 28-30.

The Symposium will discuss various water problems of a national scale, giving particular emphasis to the role of research in their solution. Five general topics will be considered: Water demand; Water supply; Efficient use of water in non-irrigated agriculture; Efficient use of water in irrigated agriculture; and Multiple use of water resources.

After formal presentations of the major problems have been made, a discussion of the role of research in dealing with these problems will be held. The program has been arranged so that discussion from the floor by those in attendance will be feasible.

Selection and use of . . .

Dial Indicating Pressure Gauges

by W. L. BUFFENMYER
Chief Application Engineer, U.S.Gauge,
Div. of Amer. Machine & Metals, Inc.
Sellersville, Pa.

EDITOR'S NOTE: A wide variety of pressure gauges are available for water works use. Important among these are dial indicating gauges of the bourdon tube type for pressure measurements in the range of 30 inches of Hg vacuum to 10,000 psi. This article will guide the engineer in selecting the proper gauges for his plant.

■ IN WATER SYSTEMS, good performance frequently depends upon existing pressures or pressure changes. To assure proper operation, the correct pressure gauge must be selected. In addition, proper gauge selection can prevent excessive water loss as happens, for example, when a distribution line breaks. A gauge that lacks the necessary degree of accuracy may not show this loss, particularly if the break occurs some distance from the pumping station. An accurate gauge, on the other hand, will indicate this drop in pressure almost at once.

This discussion deals with dial indicating gauges of the bourdon-tube type used for pressure measurements in the range of 30 inches of Hg vacuum to 10,000 psi. The objective is to give the engineer information and characteristics that are helpful as well as necessary for proper gauge selection.

Selection Factors

The following paragraphs discuss the more important factors which should be considered in selecting the right gauge.

Wear Conditions

Pulsating pressures, sudden shocks, and gauge vibration can seriously affect gauge accuracy and life. The ASA definition of pulsating pressure is similar to that for fluctuating pressure but is differentiated as having a cyclic regularity of variation. Rapid pulsations cause the gauge pointer to oscillate to the point that it is almost impossible to take a reading. In addition, they can cause excessive wear of the gauge mechanism and destroy gauge accuracy.

The simplest way to minimize the effects of pulsating pressure is to place a shut-off valve in the line to the gauge and throttle the valve until the pulsation just disappears. This method, however, invites trouble due to clogging of the very small opening through the valve. Reliable protection against pulsations can be obtained by using a pulsation dampener on the gauge. A typical type, Fig. 1, employs a throttling orifice screw which can be added to the gauge socket, or a porous metal disc, with a series of orifices which can absorb pulsations in excess of 1 cps. Such damping devices also prevent damage to the gauge from sudden and large pressure changes.

Gauge Connections

The basic types of gauge connections are discussed under Gauge Components. Where connections other than the standard 0.25 or 0.5 inch male connections are required, adapters are available.

If the gauge is installed so that a liquid column will exert a pressure due to the static head of liquid, correction must be made by a zero adjustment on the gauge pointer. This adjustment is made with the connecting piping full of liquid and the

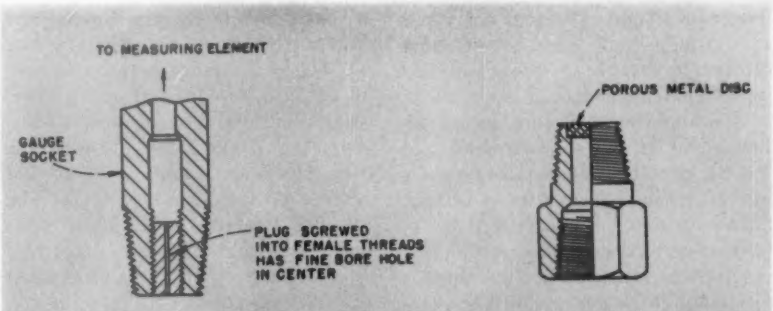


Fig. 1. PULSATION DAMPENERS protect gauge elements from harmful variations in pressure buildups. Dampener, left, employs a throttling orifice screw which can be added to the gauge socket. A porous metal disc, right, absorbs pulsations in excess of 1 cps.

pressure source shut off. Normally a shut-off valve should be installed in the line between the pressure source and the liquid column. Static heads occur when liquids are measured, when gages or vapors contain condensables, or when corrosion seals are used.

Gauges should always be installed with the face of the dial in a vertical position with the midscale point in a perpendicular line with the bottom of the gauge. This is the position in which gauges are calibrated and designed to operate. In other positions, weight of the parts may affect wear and influence the readings. If the gauge is to be mounted in other positions, the position should be specified so that the gauge can be calibrated under operating conditions.

Gauge Size

The nominal size of the gauge is the inside diameter of the case at the face of the dial. Available gauge sizes depend somewhat on the type of gauge, and are generally related to the degree of accuracy required.

For drawn-case gauges, selection is usually limited to dial sizes of 1.5, 2, 2.5, 3.5 and 4.5 inches. In all of these sizes for a given range, the value of the smallest graduation is the same, as established by ASA standards.

Readability and accuracy do not basically influence the selection of drawn-case gauge sizes. However, relatively large numerals on large size dials do ease the readability where, for example, there are physical limits on how close the observer can approach the gauge to read it.

For Grade A and Grade AA gauges, commonly available in sizes over 4.5 inches, the values of the smallest graduations do vary somewhat with size. In general, gauges 8.5 inches and smaller have one set of limits and gauges larger than 8.5 inches have another. These values are closely related to the guaranteed accuracies of the gauges.

Little is gained by insisting on finer gauge graduations that are compatible with the accuracy of the gauge. For example, with a Grade B gauge (2 per cent accuracy over midscale) which has a range of 0 to 600 psi, readings accurate to within 12 psi of the true value can be obtained. However, actual minor graduation limits for this range are 10 psi. To specify smaller divisions would mislead persons reading the gauge.

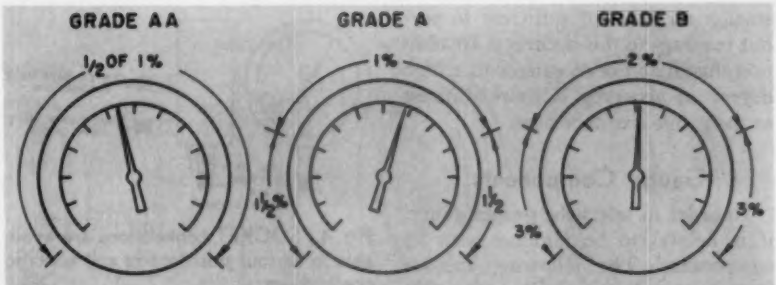


Fig. 2. GAUGE accuracies according to American Stand Classifications. For example, a 600 psi Grade AA gauge has an accuracy within 3 psi. Grade A and B gauges have one accuracy for middle half of scale; another accuracy for the remainder of scale.

Accuracy Required

Accuracy is generally expressed in terms of per cent of total scale range. It should never simply be expressed in per cent without the qualification.

The degree of accuracy specified depends upon the conditions of service, actual need for precise readings versus trend indications, and probable maintenance care to sustain the accuracy. As a general rule, the more rugged the service, the greater the compromise between accuracy and costs.

An often misunderstood aspect of stated gauge accuracies is the fact that the degree of error is the maximum guaranteed by the manufacturer. This means that the gauge will not exceed an error of, for example, 2 per cent of scale range. The actual accuracy may well be better than this value at working pressure. The gauge can be calibrated to determine the actual accuracy. However, such calibrations do not assure sustained accuracy.

Related to accuracy is the characteristic of reproducibility or consistency of readings. This is the ability of the gauge to give the same reading for the same applied pressure time after time. Consistency may be more important than the actual accuracy if the only purpose of the gauge is to tell an operator when to push a button or shut off a machine.

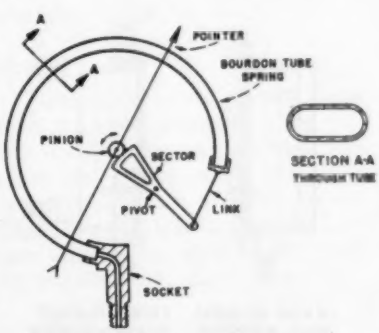


Fig. 3. CONSTRUCTION of typical bourdon-tube pressure gage. Selection of right gauge depends upon the accuracy, strength, and corrosion resistance of components.

Types of Dial Gauges

A knowledge of gauge classification is important in selecting the proper gauge initially and in the replacement of gauges. As will be seen, gauges are most commonly classified according to accuracy.

General Classifications

Pressure gauges are commonly classified according to accuracy (by ASA Standards), case style, and end use. Specific properties of each gauge type are given in Gauge Classification Methods.

The American Standard Indicating Pressure and Vacuum Gauges, B40.1-1939 (reaffirmed 1953), contains common gauge terminology and is widely used for gauge classification. This standard covers basic gauge definitions and specifications and establishes accuracy limitations for the various gauge classifications, Fig. 2.

Classifications of gauges by ASA standard accuracies automatically affects other gauge specifications. For example, Grade AA gauges of accuracy of 0.5 per cent of total scale range are not generally offered in dial sizes smaller than 4.5 inches diameter, since the readability of

smaller sizes is not sufficient to permit readings to this accuracy. In addition, manufacture of gauges to a high degree of accuracy is more difficult as the gauge size decreases.

Gauge Components

In order to select the proper gauge, it is helpful to be familiar with its components. The following are for the commonly used Bourdon-tube gauge as shown in Fig. 3: sockets, bourdon-tube springs, tube linkage, movement, pointer, dial, case, ring and crystal.

Sockets

The socket functions as a means of connecting the gauge to the pressure source. Generally, the socket provides support for all the other gauge components. Three distinct socket types are used in Bourdon-tube gauges: Bar stock, forged and cast.

For connection to the pressure source, most sockets have the Standard male connection with 0.25 or 0.5 inch National Pipe Threads. Other types of connections include female, machine threaded, alligator or hose, flare fitted, Dryseal threaded, and high-pressure threaded.

Socket connections extend from the case in various positions depending on application. The most commonly used types are low male, low-back male, and center-back male connections (see Fig. 4). Other special variations include top-connected and right or left hand connected. Back connections are generally suited for panel mounting while other connections are for mounting on pipes or equipment.

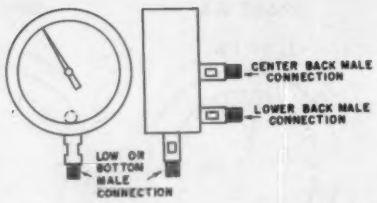


Fig. 4. SOCKET connections are available in various positions to suit specific applications.

Bourdon-tube Springs

The most critical component of the gauge is the bourdon-tube spring. This is a metal tube bent in a segment of a circle. One end of the tube is fastened to a socket which connects to the pressure source. The free end is sealed with a tip connected to the tube by soldering or welding, or by a combination of threading and soldering or welding. The tube must meet a number of stringent requirements. For continued performance, the user must select the gauge with the right tube by considering the nature of the fluid being measured, pressure range, overpressure, shock or vibration conditions and pulsating pressures.

Tube Linkage

The Bourdon-tube is connected to the gauge movement at its tip by means of a link arrangement. The type of connection required depends upon the temperature and pressures to which the gauge is subjected.

Movements

The motion of the Bourdon-tube's free end is multiplied by the movement and changed into circular motion. A small arc movement of the Bourdon tube repeatedly positions the gauge pointer over a 270° arc movement on the indicating dial.

Two plates with separating columns or posts form the cage of the movement. Within these plates are the shafts which carry the pinion and sector. The sector has a tail to which is attached the link from the Bourdon-tube tip.

Attached to the pinion, which meshes with the sector gear teeth, is a hairspring with the other end attached to a column. The spring provides tension on the pinion to reduce backlash and keep all clearances in one direction.

Materials used at points of contact are chosen to increase life and decrease wear between mating parts.

Pointers

The gauge reading is indicated on the graduated dial by the pointer. Weight and shape of the pointer affect the accuracy of the instrument and the precision of the reading.

The pointer mounts on the shaft which carries the pinion of the movement. There are several methods of mounting the pointer, each with a different degree of adjustability.

The shape of the pointer is usually compatible with the accuracy of the dial.

Dials

One of the most common dial forms consists of a metal plate coated with a background color, usually white. Graduations are printed on the coated metal. In another type

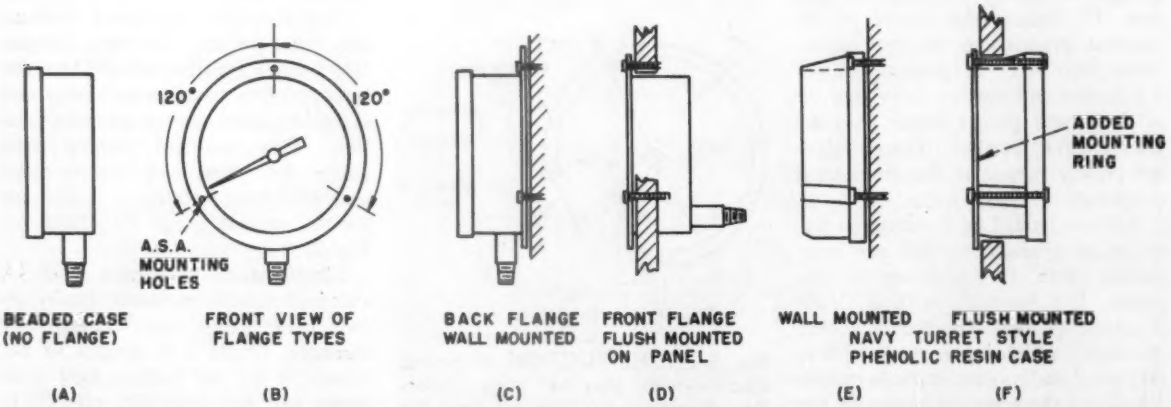


Fig. 5. MOUNTING STYLES for various gauge cases. (C) and (E) are generally wall mounted. Front-flange type is panel mounted. Beaded case is stem mounted. Turret style may be flush mounted with adapter ring.

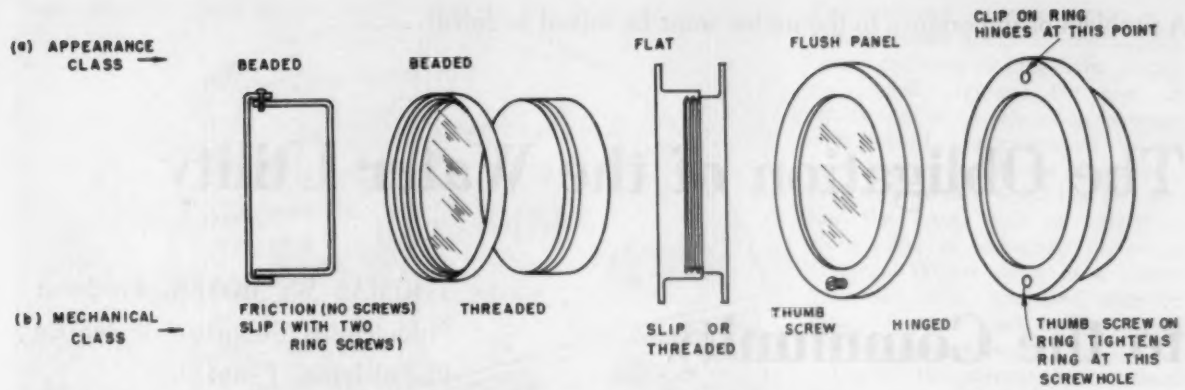


Fig. 6. HOLDING RINGS for crystals are classified by apperance and mechanical means of attachment.

the graduations are printed on white plastic and a thin layer of clear plastic is applied for protection. For readings of extreme precision, a mirrored strip around the scale eliminates parallax errors, and a pointer tip with a knife edge is used.

As an aid in selecting the right gauge or replacement part, a legend which gives the gauge model number and materials used in constructing the movement, connection, and Bourdon tube is printed on the dials of some of the larger gauges.

The dial scale is usually graduated over a 270° arc which gives a relatively long scale length for the dial diameter. The scale length contributes to readability. The number of graduations usually increases with the accuracy of the gauge, since there is little point in reading values which are more accurate than the gauge itself.

Cases

The gauge case encloses the gauge internals and protects working parts from dust, dirt, and in some designs from corrosive atmospheres. In addition, the gauge is often mounted on an instrument panel-board, wall, or machine by the case. If a gauge is stem mounted, the socket itself supports the gauge.

For safety reasons, a solid front wall may be required on the gauge to separate the observer from the gauge components. This is especially true on pneumatic applications. Such a wall is usually cast as an integral part of the case, and a weather-tight rubber disc seals the rear section, releasing pressure out the back of the gauge if the tube ruptures.

Drawn and cast cases are available in several different mounting styles. Gauges can be obtained with flanges on either the back or front of the case and with mounting holes located in accordance with ASA standards (Fig. 5). The back-flange style is used for wall or equipment mounting; the front-flange type for flush mounting on a panel.

Drawn-case gauges with beaded cases have no flange, and are stem-mounted. Cast cases are not normally available in this style, hence, a back-flange cast case for stem mounting must be specified.

The turret style is used primarily for wall mounting, but can be obtained with an adapter ring for flush mounting.

Rings

Gauge crystals are held against the case front by rings which are classified broadly into two categories: according to appearance, such as beaded, flat, flared, and peaked; and according to methods of attachment to the case, such as friction, slip, threaded, and hinged (See Fig. 6).

Crystals

Transparent cover crystals complete the gauge assembly. They protect the dial face and pointers from abuse and help to effect the gauge seal. Crystals are available in flat glass, beveled glass, cellulose acetate, shatterproof glass, acrylic plastic, and non-electrostatic plastic.

Other Measuring Elements

In addition to the Bourdon-tube, there are other measuring elements which are particularly suited to those applications requiring higher accuracy at lower pressures. The use of diaphragm capsules as pressure sensing devices where pressures are below 15 psi has long been recognized as one of the best methods of detecting low pressures. The following terms are used to define performance of diaphragm elements:

Travel

The maximum amount of travel that can be obtained will vary with respect to material thickness and diaphragm plate diameter. This can be increased by using additional diaphragm elements or by some sacrifice in linearity and hysteresis. If a high degree of linearity and repeatability is desired, the travel of the individual elements should be kept at a minimum.

Linearity

The linearity of a diaphragm capsule is the relationship between the pressure and motion expressed as a percentage deviation from the best straight line. Generally speaking, the greater the amount of motion required from a given capsule, the poorer the linearity.

Materials

Diaphragm capsules are made from beryllium copper, phosphor bronze, Ni-Span "C", stainless steel and other alloys.

Evacuated Capsules

Where measurements in terms of absolute pressure are desired, it is frequently necessary to provide evacuated capsules. Pressure to be measured is then applied to the outside of the capsule.

A problem of importance to the nation must be solved to fulfill . . .

The Obligation of the Water Utility to the Community

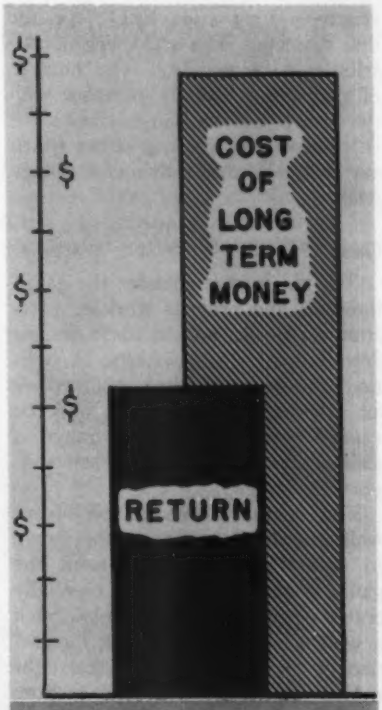
by THOMAS W. MOSES, President
Philadelphia Suburban Water Co.,
Philadelphia, Penn.

EDITOR'S NOTE: Water and Sewage Works is pleased to present this paper which is based on the author's address before the Eastern Water Company Conference, held in Atlantic City, N. J., November 11-13, 1959. Presentation of this paper is with permission of the Conference. Although in his original address Mr. Moses belittled somewhat his qualifications to discuss the financial problems facing water utilities today, the quality of this paper accuses him of false modesty. If the water utilities of this country are to meet their obligations to their communities today and in the future, they must have an adequate rate structure. This schedule of charges must be such that it will yield a return on their investment of sufficient size to at least put them in a competitive position for money in today's market. If the water utilities cannot obtain money, adequate expansions will be impossible and the demands of the population of the future for water will not be met. This, basically, is a problem of showing the water consuming public the value of their water utility and thus obtaining the support of the public for adequate rates.

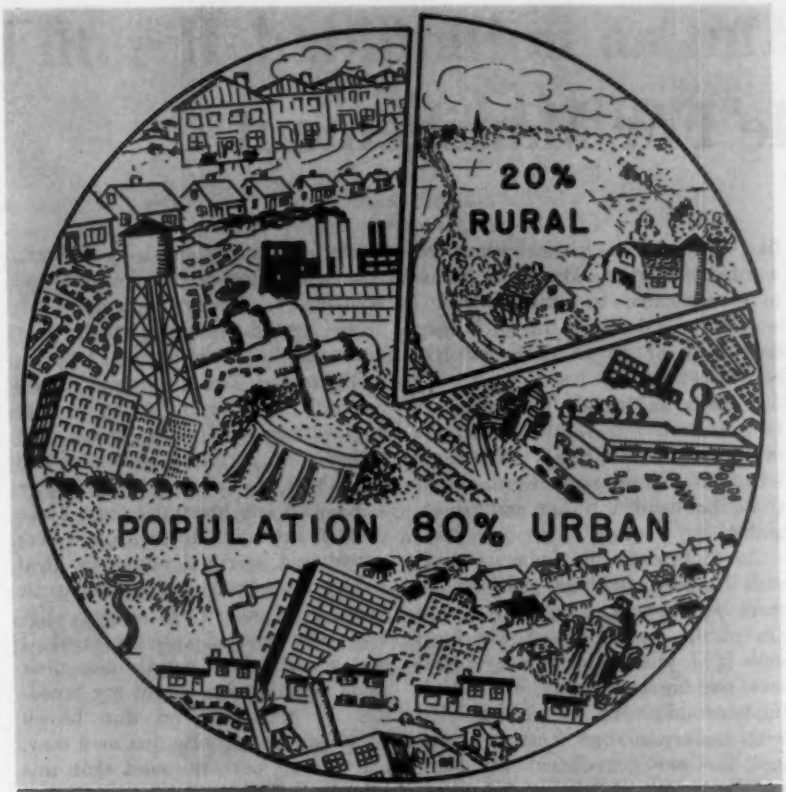
■ IT IS ESTIMATED that within one hundred years 80 percent of the population of this country will be living in urban areas. The concomitant of this projection is that 80 percent of the population in 2060 will rely on public water supplies. Assuming that the population of the country merely doubles in the same period, some 270 million people will be directly and vitally affected by decisions that the water supply industry is making today. As a matter of fact, its decisions are literally matters of life or death to these people.

A source of constant amusement are the press releases of other utilities which point out in high-sounding and sonorous phrases that they are operating under extreme pressure and terrible difficulties but they intend to make certain that every home in America has six telephones, is heated by gas or electricity, as the case may be, and, with God in their corner and blind devotion to their duty, this lofty aim will be accomplished. How ridiculous all this would be if every American home had six telephones and no water. The inescapable conclusion is that the difficulties which the water supply industry encounter are of considerable more gravity to the nation as a whole than the presence or absence of electrically-heated dog kennels one hundred years from now.

It's amazing to realize that only about 25 percent of the time of a water works executive is devoted to the problems of any given day in the month. About 75 percent of his time, and this may be conservative, is devoted to problems that are expected to arise sometime within the next 25 years. This is not an isolated instance but is the case with



THE FINANCIAL PROBLEM facing water utilities today.



ONE CENTURY from now this will be the distribution of population in the United States

just about anyone in this profession who is not completely concerned with operational detail. This fact suggests that the water works industry has an awareness of the future that challenges that found in the research laboratories of this country. It is also safe to say that the kind of planning which is done is not egg-headed but is practical in the extreme. It involves pipe in the ground, sand in the filters, and water in the reservoirs. The obligation of the water utility to the community is simply the assurance that an adequate water supply exists now and that planning has been carried out that, properly implemented, assures its existence in the foreseeable future. Of course, by water supply is meant the full cycle, from source of supply to delivery of a safe product at the tap. It is the authors belief that this obligation is being met or at least faced up to by all of the industry.

The Problem

If, then, the industry recognizes its obligation and confronts it with all the ingenuity and effort that it collectively possess, it would seem to follow that there would be no particular problem in meeting the obligation. Unfortunately, such is not the case. It would seem that anyone who would aspire to an executive capacity in this industry would have to be a financial idiot or somebody who needed work desparately, for it is obvious that in implementing its plans the industry must face hopeless financial problems. In any other business, including other utilities, expansion of plant equals increased net income and increased return on investment, assuming, of course, good management. Also, gain in customers equals increased profits and increased return. In the water supply business, however, increased plant and/or more customers inevitably leads to a decline in the rate of return, which is more important to the communities than net income, for this factor governs the water company's ability to borrow and actually build for the future.

In both companies with which the author has some familiarity, it can be demonstrated by simple arithmetic that each new customer produces a rate of return which is substantially below the cost of long-term money and wholly ignores the cost of equity capital. Even when average cost is used, total customers divided into plant at original cost depreciated, the rate of return is 0.3 per cent below the actual cost of long-term money and is constantly declining. If actual dollars spent in a recent year, say 1958, are used, rate of return is about half of the actual cost of long-term money.

Under the circumstances, these companies are actually "losing money" in the utility sense on each new customer that is added. Thus the dilemma—in the process of fulfilling its obligation for the present the company is eroding its ability to fulfill its obligation in the future.

The most unfortunate part of this complex problem is that there is no simple answer. It could be said that the matter is basically a regulatory problem and if the Commissions would give the rate change asked for within ten days of when they were asked for it all would be well, but this statement is even more ridiculous than the dilemma. Another easy out is to say that new customers shouldn't be added but this solution is the antithesis of the obligation. Perhaps the only solution is the most difficult, or at least requires the most patience. It was spelled out in Mr. John Murdock's paper before the St. Louis Convention in 1956 that has become the foundation of the American Water Works Advancement Committee.

The Water Works Industry must recognize its community obligation and must fulfill it because the alternative is chaos. The problem can be solved only by convincing the American public that it must pay a reasonable price for safe water delivered to the door twenty-four hours a day.

We must forget the motto "Water Is The Cheapest Thing We Can Buy" and substitute "While Water Is Not Expensive, It Does Cost Something", or a more apt equivalent. Unless our water companies get on a realistic financial basis, they will have no opportunity to prove that they are planning for the future for their plans will never get out of the drafting room. Millions of unborn Americans are depending on the Water Works Industry to accomplish this challenging task.

Partially Oriented on . . .

Me For Management

■ NOT BEING a reinforced concrete engineer, nor a mechanical draftsman, nor (even more unlikely) an inorganic chemist, I see that my contribution towards this talked-about Problem of Management must most likely be to offer my services as a manager. After all, if that profession is getting all gummed up on account of the lack of managers, then surely someone ought to *do* something about it—eh—not just talk about it. So if any of you are not managing properly, or are making an awful mess of things, please step aside for the moment while I investigate what is to be done.

Let us take these Agony Advertisements for instance and see who is crying for help. Aha! I see Management Selection is again looking for a bunch of up-and-coming boys. Ahem . . . well perhaps . . . . perhaps no. Those jobs don't seem to fit me. I never seem to fall into the right age group for their jobs. If you are old enough to have the experience they want, you are too old to wait for the Promised Land offered; and if you are young enough to wait, you are too young anyway. Ah! This looks better—

"Wanted: engineer able to organize cheerfully, calmly and efficiently . . ." That sounds just right for me. Organizing, that's what we should all be doing, especially doing it calmly and cheerfully: "Sorry Joe, but we must all move with the times and you have got to go. You'll be all right, Joe." (Cheerfulness). "See, I have got you fixed up with a nice pension." (Efficiency). "No Joe, just put that gun down boy; it won't do any good." (Calmness). How about that for a sample? Now, what else have we?

"Must accept responsibility and be worthy of confidence from all . . . . . Sound proven experience, ability, initiative and fundamental understanding required. Loyal service always promptly rewarded." My goodness. This job fits me like a glove. Getting one's loyal service *always promptly* rewarded is just for a chap like me who welcomes being rewarded *anyoldhow*. Mind you, I want to be reasonable about this, I wouldn't want to keep dropping my work every half hour or so to dash into the boss's office and listen to a vote of thanks all round. The best way to deal with this would be to save everything until Friday morning when all the prompt-reward checks could be handed to me pinned together.

As to fundamental understanding, well frankly, without wishing to seem big about it, I must say I was one of the lucky ones—I was born with it. I just opened my eyes and took one big look at the world and, fundamentally, that was it. I howled with understanding! Yessir, I was just *the* most fundamentalist baby you ever met. People used to look into my pram and say—"My! Isn't he the most fundamental thing you ever saw, two eyes, two legs, two . . . . ."—at which I would give one of my fundamentalistic cries, and you should have seen their funny fundamental faces fade fast away. Later it was the same with my fundamental engineering understanding; it just came to me all in a heap. I defy anyone to disclose information more fundamental than mine. Yes, there was a time when I had some *un*fundamental understanding of engineering also, just before I was passing a few examinations, but it was heady stuff. I swapped it for a copy of Mark Twain's "A Tramp Abroad," which I found fundamentally better for my spirits.

It surprises me now that the people issuing this advertisment didn't write to me direct; just everything about it seems fitted for me. Take "assisting in job conception", for instance. There's a lovely word for drawing board doodling. No need to jump around when people nag you; all you have to say is—"Sssssh, go away! Can't you see I'm concepting?" As for "controlling agreed designs", that too I agree with. Far too many designs get agreed before I can put any control upon them. The fatal thing is to let anyone get control of a design you have already agreed. Judging by the way some people control some of the jobs I thought I had "concepted" and "agreed", one would imagine that engineering was not a science, but rather, the exercise of individual prejudices.

As with any honorable firm, I see that an invitation to give one's corporeal and spiritual entity in loyal service does bring compensations. A "very good salary" is offered (figure oddly omitted). Never mind; I take it that these words have their usual meaning for one of my breeding. (I was bred on thin brown bread and butter). Be that as it may, one has to bear in mind that this job also offers "strong support and encouragement." I like that. Supposing the first week I made a mess of things; then certainly I would like some encouragement. Supposing the second week I made another mess of things; then certainly I would like some strong support. Even an assistant or two to do the work might be all that was required. I don't think any man should be so conceited as to think he can do a job all by himself, and I can quite see that, if I wanted support, a decent firm would give it. One or two of my friends would always be prepared to give the necessary support if promptly rewarded.

Well, all that remains now is to print out the application in my handiest handwriting and then post it off to . . . . to . . . . "BOX AGC 978 where applications will be treated in strictest confidence. The present staff know that this post is offered." . . . .? Now how about that, eh? I wonder who BOX 978 can be. Somebody is making a clever move here. Supposing I *never* know who BOX 978 is or was? Aha—supposing 978 is You-Know-Who: a ripe melon I should look asking for a job back with them. Supposing I sign myself "In strictest confidence, yours faith-

CONTINUED ON PAGE 112

Filter Rehabilitation as Influenced by Filter Bottoms

by M. L. STUPPY, Pres.
F. B. Leopold Company, Inc.

■ SELECTING THE TYPE of filter underdrain system in rapid sand filter plants is one of the major decisions facing the design engineer. Since the filter underdrain contributes in a marked degree to the efficiency and life of the filter, and since its location makes it a difficult and expensive item to maintain and/or repair, the selection of design and type represents a decision of far more importance than many other technical items more readily accessible.

The underdrain design also influences the basic structural requirements of the filter box. Therefore, the designer must consider not only the hydraulic features and construction materials of the filter bottom itself, but also the economics which are involved in overall structure, depth of filter media, and operating costs.

The importance of filter underdrains is emphasized when the variety of problems, and the number of installations where filter rehabilitation by replacement of filter bottoms has been necessary, is considered.

The Size of the Problem

Several months ago in a review of our total installation list of Glazed Tile Bottoms, we were surprised to discover of the more than 500 installations, over 100 had been used to replace other underdrain designs.

Expressed another way, of the approximate total installed filtering capacity of 3 billion gallons per day, over 720 MGD, or roughly 24%, represents rehabilitation.

While we had been aware there was a definite trend in recent years towards rehabilitation projects, either because of absolute necessity or to improve the efficiency of existing filter units, the total capacity of the plants in which this has occurred seemed to represent a significant statistic; one which warranted further investigation.

Rehabilitation Statistics

In an effort to assemble pertinent statistical data, we sent a questionnaire to each plant in which we had performed rehabilitation, asking about the types of problems that had been encountered with original installations, and the total costs which were involved in the reconversion. Combining the answers we received with information in our own files, we developed some revealing statistics.

It was found, for example, that 54% of the plants that required rehabilitation had been in service less than 25 years, and another 35% had been in service for less than 20 years. Of this latter group, 20% had previously replaced original underdrains one or more times, accumulating a considerable cost in terms of the filter underdrain item.

The data also reveals that failures or poor performance, either or both of which lead to replacement, results from: (a) Structural failure of the underdrain system; (b) Shifting of sand and gravel; (c) Clogging or Cementation of the filter bed; (d) Clogging of underdrain.

Of the plants where replacement occurred, 85% reported they had experienced physical failure of the existing underdrain system. Of this group, 20% reported other troubles have also been common, such as poor wash water distribution resulting in frequent gravel mounding and upset beds; poor wash results leading to clogging; reduction of filter rate and runs; and in some cases, cementation.

The 15% that did not experience physical failure reported replacement because of upset beds and poor wash distribution with accompanying reduction of filter efficiency capacity. In some major plants, media regrading, an expensive and time consuming project under any condition, was required every two or three years.

The costs of such recurring regrading over a period of 15 to 20 years far exceeds the original investment involved in a corrosive proof underdrain and wash water system of sound hydraulic design.

Types of Underdrains Replaced

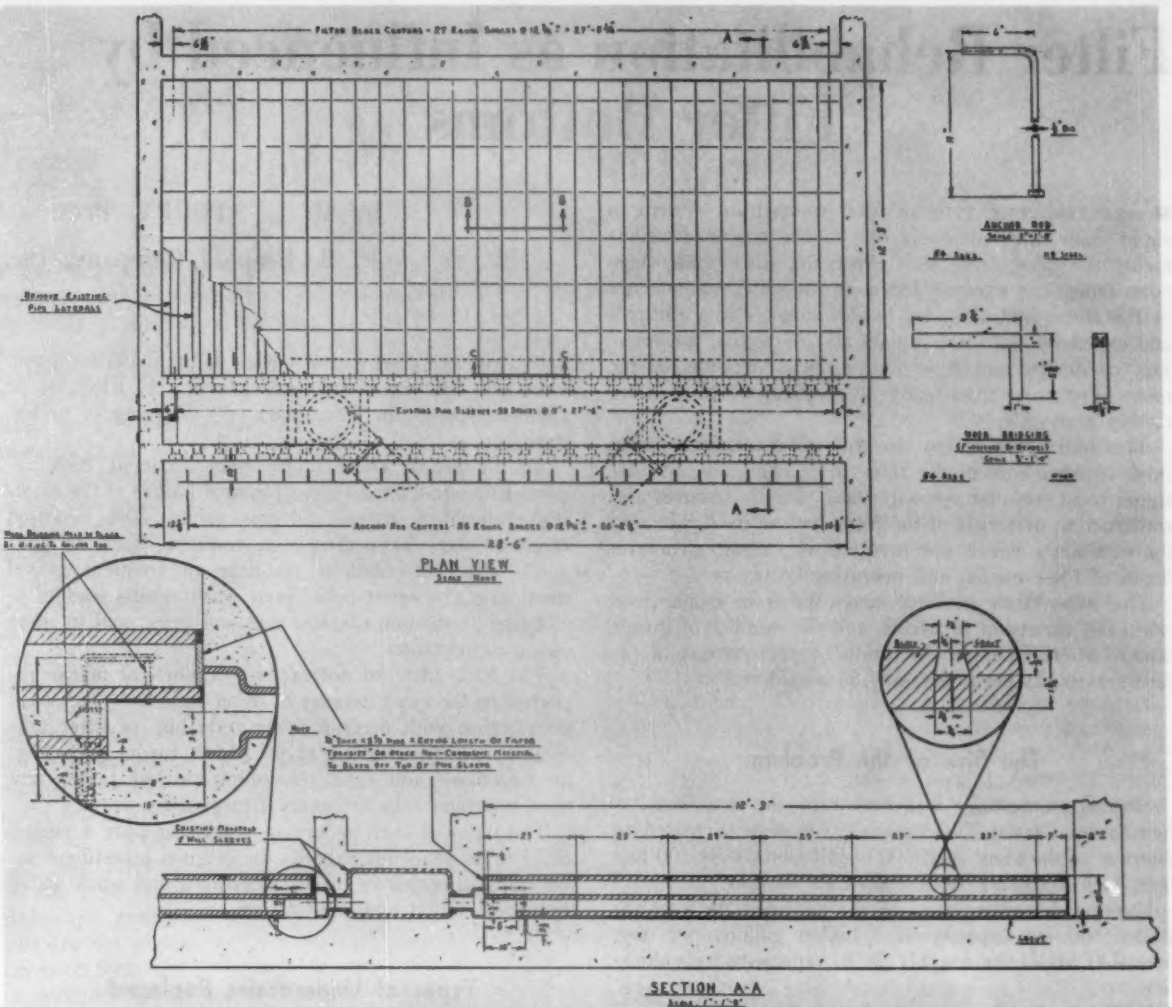
The types of underdrains which have been replaced and the various types of failures experienced also provide some interesting statistics.

Cast Iron Laterals

Of all plants rehabilitated, 57% were equipped with cast iron lateral systems. Total capacity of this group of plants was 287 mgd. Corrosion and tuberculation were the main contributors to physical failure in this group.

This group also experienced the majority of cases of gravel mounding and media upsets uncovered in our survey. These were due to poor wash water distribution and dispersion by the underdrain, an indication that where lateral underdrain systems are employed, the engineer must be careful in the selection of lateral and orifice sizing, and wash water manifolds so as to deal with reasonable velocities and applied discharge to the gravel bed.

The dependence upon a large depth of gravel for effective wash water distribution can make this type of design a victim of channelling or horizontal velocities through the gravel bed, to a degree depending upon the compactness of the media. This increases the probability of gravel migration and mounding.



ADAPTATION OF Leopold Bottom to existing Cast Iron Manifold in double bay filter.

Mr. J. R. Baylis' many excellent articles on this subject and the revealing photographs accompanying them represent, in the majority of cases, actual experience with filters equipped with lateral types of underdrain systems. It is extremely uncommon to encounter plants so equipped that do not require media rebuilding and regrading in less than ten years.

Engineering News-Record recently published an article describing the methods involved in the regrading of gravel in the Chicago Plant after a period of approximately 12 years service. In the light of the tabulation of data collected, this represents an unusual period of trouble-free operation.

Baltimore Types

While the remaining percentage of installations replaced involve only 43% of the numerical total, the capacity of this group is 428 mgd, or almost 50% more capacity for a lesser number of plants. More than half of this total is represented by two plant installations, Montebello Plants Nos. 1 and 2, City of Baltimore, Maryland. One of these was equipped with wood slat underdrains and the other with a concrete block and strainer underdrain. Eliminating these two projects, the total of other types replaced is 200 mgd.

Other Types

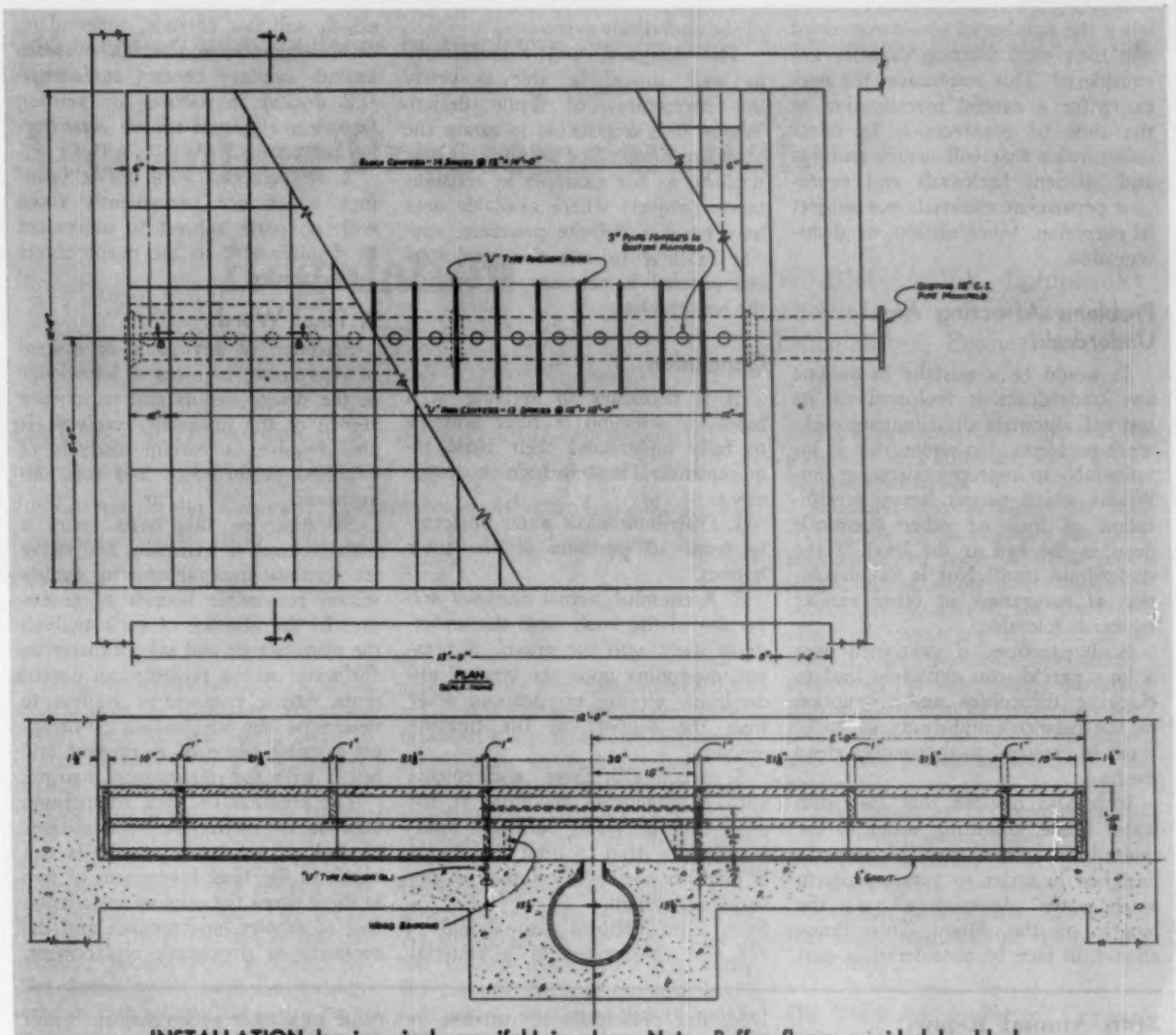
This group involves a variety of systems including several concrete block types, such as the original Leopold concrete block system, The Wagner system, porous plate types, various false bottom strainer types, and the Wheeler type.

Concrete Blocks

In every case involving the concrete block installations, aside from

Table I
Rehabilitation Statistics
Covering 104 Plants

Type of Underdrain Replaced	Percentage of Replacements	Group Capacity MGD
Cast Iron Laterals	57%	287
Baltimore Types One Wood Slat Plant One Concrete Block-Strainer Plant	2%	228
Wheeler	1%	10
All Others Concrete Blocks, Wagner & Leopold False Bottom Strainer Other Wood Slat Porous Plate	40%	195



INSTALLATION leaving single manifold in place. Note: Buffer flume provided by blocks.

any mal-distribution of wash water, which might have been encountered with accompanying media problems, physical failure was due to disintegration of the precast concrete blocks. This can be attributed primarily to lack of proper curing leading to eventual disintegration.

The many Wagner and Leopold concrete block installations which have been in satisfactory service for many years indicates that this type of material will last indefinitely under ideal conditions. The many replacements indicates it is essential with precast concrete underdrains the material be of high quality, properly cured, and adequately reinforced.

False Bottom Strainer and Wood Slat

False bottom strainer and wood slat replacements have been mostly the result of improper wash distribution or dispersion causing frequent media upsets and accumulated out-of-service time.

Porous Plate

The number of porous plate replacements is attributable, in almost all cases, to misapplication of this type of underdrain. Clogging, of course, is the basic reason of physical failure. Application of this system must be limited to waters free of any material apt to clog the plates. We actually witnessed an instance where concrete piers which supported plates were actually blown off the floor of the filter due to excessive clogging.

Wheeler

We have replaced Wheeler underdrains in only one plant involving ten 1 mgd filter units. This was a monolithic installation and the lack of any additional replacements establishes this as a rather permanent type of underdrain installation. The newer precast Wheeler type should represent an equally permanent installation providing blocks are properly cured and adequately reinforced.

Costs

Our questionnaire also revealed that the average cost per square foot of filter area for replacement of underdrains is about $9.00 or, on a 2 gallon per minute per square foot rate, approximately $3,150 per million gallon capacity. The major portion of this is the cost for the removal of existing sand, gravel, underdrains, the regrading of gravel and sand, and replacement over the new filter bottoms.

This dollar amount is significan

when the number of plants converted and their total filtering capacity are considered. This emphasizes the necessity for a careful investigation at the time of construction to select underdrains that will insure uniform and efficient backwash and represent permanent materials not subject to corrosion, tuberculation, or disintegration.

Problems Affecting Any Underdrain

It would be a mistake to assume any underdrain is foolproof or its use will automatically eliminate backwash problems. No underdrain is invulnerable to improper operating conditions which permit heavy precipitation of lime or other chemicals deep in the bed at the level of the underdrain itself. Nor is the deposition of manganese or other similar materials tolerable.

Such practices, if continued over a long period, can definitely lead to clogging difficulties and disruption of the balanced uniformity of backwash so essential to thoroughly clean media.

It is also obvious that the wash water flume, admitting water to the underdrain system, must be properly designed in order to assure uniform wash water admission along the length of the filter. This flume should, in fact, be considered as part of the underdrain system.

The designer, and manufacturer as well, should be able to verify the correctness of flume design. Where it is impossible to attain the optimum design due to physical limitations, as for example in rehabilitation projects where available area may be at a definite premium, special baffling to suit the conditions encountered is necessary to provide the best results.

Conclusion

It is necessary in arriving at a basis for selection of filter bottoms to fully understand their basic requirements. These include the capacity to:

1. Distribute wash water uniformly from all portions of the filter bottom.

2. Accomplish actual *designed dispersion* of the wash from the underdrain itself with the gravel, if present, depending upon the type of underdrain, serving no purpose other than the support of the filtering medium.

3. Accomplish these requirements with a reasonable headloss, at the same time providing sufficient *built-in* pressure drop to limit the effects of pressure variances common in any backwash system.

Such filter bottoms also should:

1. Be constructed of a material which will not corrode, tuberculate, or disintegrate, and which provides smooth sanitary contact surfaces.

2. Include a natural air venting feature to eliminate any *air blast* during backwash.

3. Be equipped with orifice openings which are permanently fixed with no parts subject to movement or displacement in the event of air accumulation.

A Final Word

Selection of any piece or system of equipment requires a knowledge of the design details and experience record of the materials involved. It also requires a careful analysis of expected performance and total investment.

Selection on this basis spurs a manufacturer to maintain, and strive for constant improvement in, quality within reasonable bounds of economy. In the absence of such analysis the manufacture and sale of materials for water works projects can degenerate into a competitive contest to determine who can produce the cheapest possible piece of equipment and sell it with the minimum of margin.

The creation of such competition because of ineffective specifications or lack of minimum standards can result in the final investment of two to three times the original installation cost of repairs, maintenance and the necessity of premature replacement.

30th Annual Report Hartford, Conn.

More than 15½ billion gallons of water were supplied at an average rate of about 42⅔ million gallons per day, some 2⅔ million gallons a day above that delivered last year, according to the Thirtieth Annual Report of the Water Bureau of Hartford Connecticut for the year ending Dec. 31, 1959.

About 21 miles of pipe were added to the system during the year bringing the total miles of pipe in service to 946.

A new meter rate schedule designed to provide about 20 per cent additional revenue became effective April 1, 1959.

Gross revenue for 1959 amounted to $3,893,107 as compared with $3,315,807 in 1958, an increase of $577,299. Water sales totaled $3,802,045, an increase of $573,357 over 1958, due principally to increase in water rates. Sale of water for industrial purposes in 1959 amounted to $740,488 as compared with $629,066 last year an increase of $111,422.

5th Annual Report, 1959-60, Redhill, Surrey, England

There has been continued growth in the Water Research Association of Redhill, Surrey, England, according to its Fifth Annual Report of 1959-60. Amalgamations among water undertakings have lowered the actual number of members. The 1960 count totaled 239 members.

The response by members to the Association's request in 1959 for doubling of their dues has been very satisfactory. The normal dues for 1959 totaled $70,000 and members made a voluntary contribution of $44,800, which provided sufficient income to attract a Government grant of almost $68,200.

This year's research is the first of five for which a Government grant is forthcoming. As soon as facilities are available at Medmenham, which will be ready for occupation in the first months of 1961, existing lines of research will be expanded and new investigations begun.

The work on the coagulation process of water treatment has continued and during the year the first three of a series of reports on this research have been circulated to members. For the detection of underground leakage, the prototype detector has been designed to give a rapid indication that a position is free from leakage vibrations. The detector requires further development to improve its electrical reliability and to make some improvement to its sensitivity.

Understanding utility problems by regulatory agencies and the rate paying public may be the key to . . .

Accounting Problems in Rate Regulation

by W. B. GAMBLE, Comptroller
American Water Works Co.,
Philadelphia, Pennsylvania

EDITOR'S NOTE: Another in our series of articles pertinent to private water utility operation, this paper was presented before the Eastern Water Company Conference in Atlantic City, N. J., November 11-13, 1959. The paper is included here with permission of the Conference.

■ ACCOUNTING PROBLEMS IN RATE REGULATION is a rather restricted subject, and at first might seem of interest to only a very few readers. Strictly accounting problems in rate making are, in fact, not too bothersome for a trained accountant. So some liberties will be taken in order to discuss problems that are not solely accounting problems. The reason for taking these liberties is that accounting points these problems up. The bothersome problems encountered in rate making today are really everyone's problems and they are known to everyone primarily concerned, including the regulatory bodies, their staffs and the company technicians. The real question is—what can be done about them? Since a satisfactory solution cannot be determined unless the problem is first presented clearly and persuasively, the presentation becomes of primary importance.

Accountants by reputation are precise individuals who stand on the premise that two and two make four and heaven help anyone who dares question their arithmetic. They quote debits and credits and expect all but the low grade moron to show complete comprehension. Fortunately, regulators usually understand our language. But regulators in turn have their problems, not the least of which is to gain the confidence of the rate paying public.

There is ample evidence in water rate orders that accountants have yet to find the key to proper presentation of the problems to the regulatory bodies so that regulators can then prescribe a solution acceptable to the public. Accountants may have demonstrated their case to the commissions, but they certainly have failed to educate the public, the ordinary citizen, who is the rate payer. As the public is the third party in the triangle formed by the utility, the commission, and the rate payer, it is just as important that the public has some understanding of rate making processes as it is for the commission and the utility. Obviously, this is expecting a great deal, but there must be some genius in this world who could devise a way to present a rate case in such a manner that the public could understand the basic issues and accept an equitable disposition of the issues within the framework of the regulatory processes.

Perhaps this genius is an accountant with a flare for public relations, or perhaps he is not a genius but a team of two skilled technicians working in harmony: an accountant and a public relations man. At any rate, it seems that accountants could utilize the skills of the public relations man. This might enable them to arrange their figures with some glamor, on the order of "Arithmetic Can be Fun". But since this paper deals with accounting and not with public relations, perhaps it can present the problems and hope that its statement will stimulate some thinking and some ideas.

Although the problems in rate making are many, probably the more important and more difficult problems affecting water utility rate regulation today are: 1. the combined effect of regulatory lag and inflation; 2. the "no risk—low return" concept of the water utility business; 3. the exclusion of projects under construction from the rate base; and 4. the proper allowance for depreciation.

Regulatory lag has been discussed and written about time and time again, and attrition or inflation and its problems is the subject of another paper in this series. Therefore, this article shall confine itself to the other three.

The "No Risk—Low Return" Compact

We have all heard, at one time or another, that the water utility business is practically a "no risk" business. The argument goes on that water is a necessary commodity without the competition that we find, for example, between gas and electricity, and between those industries and coal or oil; and that the business of furnishing water is not as sensitive to economic good times and bad as is the business of furnishing other utility services. Then, too, there is the long history of cheap water which has accustomed the public to low water rates, especially when compared with other utility rates. Being considered a business with little or no risk, it is felt that its securities are guaranteed a continuing return and, therefore, attractve to a certain class of investors including widows and pensioners who seek a steady, if low, return.

On top of this, the water industry

is faced with what appears to be a reluctance of commissions to break through the traditional 6% maximum rate of return. Rates of return for water utilities have more often been less than 6%. It is true that rates of return throughout the years have varied, but somehow over the years, particularly since about 1933, a rate in the neighborhood of 6% has remained the magic figure. It is only recently that some commissions in certain cases have exceeded a 6% rate of return but, in practically all such cases, it has been a telephone company. There have been some scattered instances where water companies are allowed a rate of return in excess of 6%, but they mostly have been small companies with service difficulties. This is in spite of expert testimony on behalf of the companies, usually undisputed, that "bare bones" cost of money is 6½% to 7%. The magic of 6% is baffling. It has no support whatsoever except tradition. Of course, some companies can live comfortably with a rate of return around 6%, but many, many others require considerably more.

For illustration, consider a review of the operations of a water company with gross revenues of almost $1,000,000. Rate making for this company should be relatively simple as its property is recorded at original cost, the original cost adjustment has been disposed of, its book reserve approximates its reserve requirement, its annual depreciation rate is fixed by the commission, and its financings have had commission approval. In two rate cases since 1954, it was allowed a rate of return of 5.7% in the first and 6.0% in the second; whereas it requested 5.9% and 6.5%. The rates allowed produced a return so low that the company operated at a loss for 1958 and earned over 4% on common equity in only one year since the first rate case. This reflects attrition to some extent, but the rates allowed were too low without considering attrition.

Another company had a rate case in 1952 and another in 1956. In the '52 case, uncontested testimony showed that its "bare bones' cost of money was 6%. It requested a rate of return of 6.8%, and was allowed 5.9%. In the '56 case its cost of money was 6.7%; it requested a rate of return of 6.7% and was again allowed 5.9%. As a result, it has not been able to accomplish some vitally necessary financing. In the years 1952 through 1958, it has never earned more than 5.3% and averaged only 4.3% on its rate base; the return to common has averaged 4.4% and never exceeded 7.7%; and the coverage on its indebtedness has averaged less than 1.1 times in the most recent five calendar years.

The bonds of these two companies do not meet the minimum standards of the Committee on Valuation of Securities of the National Association of Insurance Commissioners.

These cases are not unusual. Here, at random, are the cases of four other companies—small, medium and large. Only one of the four companies earned its allowed rate of return in the first year following the effective date of the rate increase. The others failed to earn the allowed rate of return by from one-half to seven-tenths of 1%. Percentage-wise, this averages out to about a 10% reduction and dollar-wise, it is of considerable concern. This again reflects attrition to some extent, but the fact remains that the allowed rate of return is not sufficient.

In a recent article in "Public Utilities Fortnightly", the Honorable William R. Connole, member of the Federal Power Commission, stated that ". . . . . it seems significant to this author that no natural gas pipeline has successfully demonstrated the level of return to which it is constitutionally entitled to enable it to meet the test of competition in the high-cost money market that has prevailed in the last few years". The same observation, with even more emphasis, can be made of water companies.

What to do about it? The author is the first to admit that he does not have the complete answer. But somehow, we accountants, with all the figures available to us, and with all our experience in putting those figures together, must somehow find a way to arrange them in a pattern that will convince our regulators and our rate payers that we must have more realistic rates of return.

While, primarily, the inadequacy of rate of return has been considered, in so doing it is impossible to avoid entirely the inference of attrition. Since attrition has made itself felt, the author would like to call attention to a thought provoking idea that A. R. Colbert, Chief Accountant of the Wisconsin Commission, presented at the recent N.A.R.U.C. annual convention. The paper is worthy of consideration by everyone concerned with rate making. He suggested, briefly, that the return might be increased according to the rate of inflation, the increase in dividends required thereby, and the increased amount required for surplus to maintain its integrity.

Exclusion of Projects Under Construction from the Rate Base

In recent years most commissions have excluded projects under construction from the rate base. This is usually done because the property is not in service and therefore not considered to be used and useful in rendering water service. It has been felt that properties included in the base must meet this test. Other reasons advanced are that the revenue from new customers will produce a return on the new property, and that if interest is capitalized during construction the need for return on property under construction is eliminated.

In the author's opinion, projects under construction and even projects contracted for, or definitely authorized, should be recognized as part of rate base. And this is aside from any consideration of lag or attrition. It is inconceivable that dams half finished, or pipelines only part way to their destinations, will not be completed. No prudent management would leave such monuments.

The ultimate concern in the fixing of rates is the end result. A utility must have adequate earnings, not only for a test period but for the years immediately following. Rates are fixed for the future. Therefore, any schedule of rates designed to provide income for the immediate future cannot possibly accomplish its purpose if it fails to provide a return on dollars already spent for facilities at the time the rates are fixed or which will be spent shortly thereafter.

The erroneous impression that new customers provide return at an increased rate probably stems from the economics of the electric, and to a minor extent of the gas, industry. Once an electric company builds a dam, the water flowing over that dam can produce increasing amounts of electricity with little or no additional plant expenditures. As new customers are added, only relatively

cheap transmission and distribution lines are needed. Industrial customers are sought after to increase the load. Electric companies can also increase the voltage sent over the wires. Gas companies can compress the gas and transmit greater quantities without increasing the size of mains.

Water companies, on the other hand, cannot get more water without increasing their facilities; they cannot compress their product for transmission; they have to treat the water the same for all customers, industrial and residential. New facilities must be installed to serve new customers.

Most water works properties date from the middle or late 1800's. The Engineering News Record construction cost index, starting with 1903 and worked back by engineers of American Water Works Service Company to 1879, based on 1913 as 100. is 118 for 1879, 101 for 1900, 207 for 1925, 509 for 1950, and 724 for 1957. Other cost indices show comparable trends. Today's customer is, therefore, paying water rates to provide a return on some property that cost only one-seventh of what it costs to install similar property today. Obviously, under the same rate schedule, new customers cannot possibly provide a fair return on new property installed for them with present day dollars. Thus, the new property, instead of producing an adequate return by providing service to new customers, only pulls the present rate of return still lower.

Suppose, as a simple example, we consider a plant consisting of 10 services of equal length and size, installed on the dates just mentioned. They are attached to a distribution main installed in 1879, direct from a well supply. The well and distribution main together cost $640. There were 2 services installed in 1879 at a cost of $6.60 each, 1 in 1900 at $15.39, 4 in 1925 at $27.25 each, 2 in 1950 at $58.64 each, and 1 in 1957 at $84.00. Meters were installed on the 1879 and 1900 connections in 1925 and on the others at the dates of connection. The total investment is now $1,000. Each customer uses the same amount of water for which he pays $26 per annum. The total annual revenue would then be $260 and the return, which averages about 25% of revenue, would be $65 or 6½%. Now, a new customer is added, who uses the same amount of water as the others. In addition to the outlay for his service and meter, which in 1959 cost $96, an extension of the main costing $125 is required. He produces additional revenue of $26, and additional return of $6.50. But the rate of return on the additional investment is only 2.9% and the overall rate is reduced to 5.9%. Some studies made recently indicate that new customers actually provide a rate of return on property installed for them even lower than the 2.9% in this example.

RATE MAKING processes should be explained to the rate-paying public.

The water industry tries to overcome this by requiring construction deposits. But because they are limited to the cost of a certain number of feet of main, or by other measurements, they do not take care of all the revenue producing installations. Further, expenditures required for non-revenue producing reinforcing mains, transmission mains, pumps, supply facilities, etc., are also not included.

The argument that construction work in progress should be eliminated from the rate base if interest is capitalized confuses return with cost. Interest capitalized is not return to the investor in any sense. It is purely and simply a cost of construction, cost for the use of money. As a construction cost, interest is capitalized only during the construction period. Its capitalization stops when construction is completed. If it ever did take place of return, the need for a return in its place arises at the moment construction ends. But if it has not been provided for in the rates, it is lost until the next rate case.

There have been a few cases from time to time where projects under construction or definitely authorized have been included in rate base, usually where improvements were absolutely necessary to improve service. Recently, however, the New Jersey Board has taken some steps toward including uncompleted projects and even planned projects in the rate base and it has been upheld by the courts. Both the board and the court talk of attrition, and their interest is not always clear, but the allowances have been related to construction. The notable case is the New Jersey Bell Telephone case decided by the Board in 1958 in which it appeared that $25 million of committed construction projects were included in the rate base. That case was remanded to the Board by the Supreme Court only because the court thought the Board had not correlated the specific amount allowed to any particular justifying factor, including attrition. The Board made similar allowances in two later water company cases—Plainfield-Union Water Company and Hackensack Water Company. The Supreme Court upheld the Board in the Hackensack case and, since it remanded the Plainfield-Union case for other reasons, it directed the Board to specify its basis for *limiting* the amounts planned for new construction included in the rate base. Significant language of the court in the Plainfield-Union case is: "The allowance for future construction by the Board in this case appears to have been founded on the concept that since the new extensions and additions to plant would come into existence at or reasonably soon after the time when the revised rates were to go into effect it was reasonable to anticipate them in the rate base. Moreover, since frequent and repetitive rate application proceedings are burdensome and expensive, and to be avoided if unnecessary, the anticipation in rate base of reasonably certain

net additions to utility plant in the immediate future, particularly where a type not calculated to produce added revenue, would appear within the area of permissible agency discretion". The Court went on to say that: "The principle thus enunciated . . . has validity and relevance to the instant case, entirely apart from considerations of inflation or attrition of return, which were not stressed in the argument before us in this case, although that principle is accentuated in significance by such factors in the existing economic climate".

Proper Allowance for Depreciation

This same combination of circumstances, early incorporation, low cost of original properties, and long life of property, plague water companies with the third problem under discussion, the proper depreciation allowance. Water companies have, over the years, provided depreciation in conformity with the theories currently in vogue, as has every other properly managed company, whether regulated or not. The cycle, briefly, progressed from the period of replacement accounting which did not recognize depreciation, to providing depreciation in amounts deemed reasonable by the directors, to providing for retirements, to providing for depreciation on one of the several theories generally accepted at the present time. During the last 30 or 40 years of this cycle, water companies have been regulated in most states and their depreciation policies have been under continuing scrutiny of the regulatory commissions. The whole matter has been in the open, above board, and in conformity with generally accepted theories of the times. Other utilities were in the same position but, because of the shorter lives of electric and telephone properties, and the technological developments in the electric and telephone industries, the older electric and telephone properties have been retired. The present depreciation reserves for those utilities are therefore allied to properties installed during periods of relatively modern depreciation theories. On the other hand, the older, low cost water properties are still in use, and the increase in units installed later is represented by a disproportionately large increase in dollars. Thus, the properties installed years ago, when depreciation theories were different, are still in use. This, together with the disproportionate increase in dollars invested, results in a reserve that appears on the surface to be too low.

The apparent low depreciation reserves against water properties have misled some technicians to believing that there must be something wrong, and that the reserves should be recomputed as though the present depreciation theories had been or should have been recognized throughout the companies' lives. They have, therefore, applied straight-line depreciation throughout the entire life of the properties.

Straight-line depreciation has gained wide acceptance in recent years because of its simplicity and because any other method is more difficult to have approved for Federal income tax purposes. But, engineers experienced in water works properties have found that such properties do not depreciate uniformly over their lives; they depreciate very little in their early years and faster in their later years. Therefore, to apply a depreciation theory not ideal in the first place, to properties which have been depreciated over the years in conformity to good practice, is not even sound hindsight; particularly when the depreciation practices have been subject to regulation for the past 30 to 40 years. Of course, other methods are recognized in some jurisdictions. Pennsylvania, for example, recognizes the 4% compound interest method which is more closely related to the way engineers say water property depreciates.

If, however, it is in the best interest for water companies to get on a straight-line depreciation basis, the only fair way to accomplish the goal is to allow annual charges sufficient to depreciate the property over its remaining life. This is, in fact, no more than most unregulated companies do as a matter of course. It is an inherent part of straight-line depreciation. Few, if any, properties depreciate uniformly over the 5 to 100 or more years of their existence and even like units do not have the same service lives. As no one has sufficient prophetic power to predict the lives of units of properties at the time they are installed, adjustments must be made as experience is gained. Even though water companies are among the oldest of enterprises, sufficient experience has not yet been gained to predict the service lives of the great mass of water mains with any degree of accuracy.

Sound reasoning would require recognition of the book reserve, in the absence of course of managerial abuse, and remainder life depreciation if such is found necessary. In some jurisdictions, Pennsylvania for example, the problem is not quite so acute, because the use of a fair value rate base necessitates a redetermination of the depreciation reserve applicable to the fair value of the properties. Other states, New Jersey for example, usually recognize the book reserve. But in other jurisdictions, we have somehow failed to present our case in such a manner that the logic of this position is accepted. We have sought support from independent accountants and engineers skilled in water works history and practices. Perhaps we, in the water works field, should document our cases better. Somehow, either we have to be more convincing than we have been, or we have to show the commissions how they can make it understandable and acceptable to the ratepayers.

Summary

We all know our problems, we all no doubt have some ideas of what must be done to solve these problems, but we must discover better ways of presenting the problems which point the way to solutions both to the regulatory bodies and to the public.

Me For Management

CONTINUED FROM PAGE 104

fully, A. Melon" then what? No that won't do. What about this "present staff" too—are they a jolly lot ready to welcome another Cheeryble Brother to the firm, or have they all got daggers in their belts? Perhaps I should write and say I will attend for interview wearing a mask on which "BOX AGC 978" will be stencilled in red; that should keep the cards even.

In the meantime, (confidentially), shouldn't a confident man stride up the front doorsteps of a firm and bang on the knocker, rather than sneak out of the back door of one firm into the back door of another—or is this Pinkerton's Inc. wanting an assistant?

An extended study showed operating efficiency can be increased by . . .

Lubricating Centrifugal Sewage Pumps

Wearing Rings

by C. E. KEEFER and H. S. BECKER
Sewerage Engineer and Superintendent of Pumping Plants, Bureau of Sewers, Baltimore, Maryland

RESUME: More than eight years work has been expended by Baltimore's Bureau of Sewers to develop a method for adding lubricating oil to the wearing rings of centrifugal sewage pumps. This method utilizes waste oil from the city owned garage, and the lubrication has been successful in keeping the dirt out of the space between the rings, thereby reducing the wear of these rings from about 0.029 to 0.001 inches per billion gallons pumped.

■ ONE OF THE OPERATING CONDITIONS which reduces the efficiency of centrifugal sewage pumps is the increase in the clearance between the suction eyes of pump impellers and the adjacent pump casings due to erosion. Many sewage pumps are provided with bronze or stainless steel wearing rings, one on the impeller and the other on the pump casing, which can be removed and replaced with new rings when the clearance between the rings becomes excessive. A method that has been successfully used at three of Baltimore's sewage pumping stations to greatly reduce this wear has been the introduction of a small quantity of lubricating oil into the space between the rings during pump operation.

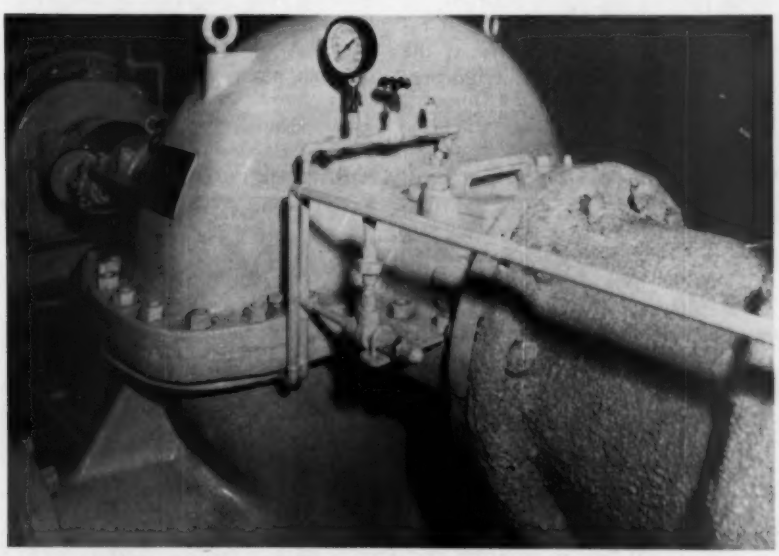


Fig. 1. POINT OF ENTRY of oil pipe into pump casing and wearing rings of the centrifugal pump at the Brooklyn Sewage Pumping Station.

Wearing rings of centrifugal pumps are subject to greater wear when pumping sewage than when pumping water. This condition is caused by the high percentage of gritty and foreign materials in sewage. As Baltimore is served by a separate system of sewers, the grit in the sewage is not excessive. From 1950 to 1959 inclusive, the quantity of grit removed from the sewage at the Back River sewage-treatment works, the city's main plant, averaged 1.7 cu ft per mil/gal of sewage. Observations made for several years at three of the sewage pumping stations in Baltimore have indicated that the clearance between the wearing rings of the centrifugal pumps has increased at the rate of 0.029 to 0.044 in. per billion gallons of sewage pumped. As this clearance increases, more sewage flows back between the rings from the high to the low pressure side of pumps and consequently the efficiency decreases.

It was thought that perhaps the introduction of oil between the wearing rings might reduce this erosion. This idea was first tried in a rather crude way on a 30 mgd double-suction centrifugal pump. A small hole was drilled through the pump casing and the bronze wearing ring in the casing. A small brass pipe was fitted into this hole, and an oil cup, equipped with a hand pump, was attached to the upper end of the pipe. Every half hour about one pint of oil was injected into the space between the wearing rings. As a result of several

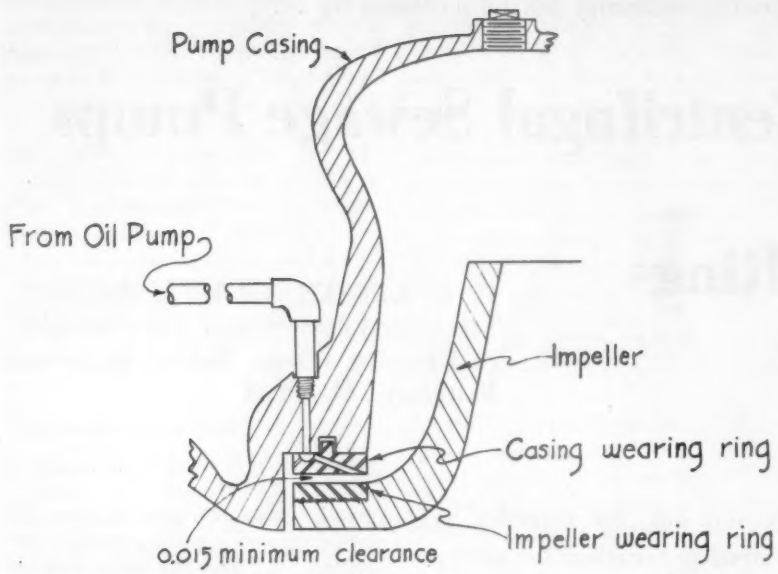


Fig. 2. OIL PIPE CONNECTION to wearing rings of the centrifugal pump.

months of operation, the rings showed less wear and less tendency for solids to accumulate between them. Subsequent to these observations a much more satisfactory way of feeding oil was devised. A small rotary-type displacement pump was fastened to the outboard bearing of one of the centrifugal sewage pumps. The end of the shaft of this pump was provided with a pulley which was driven by a V-belt. This belt engaged a split pulley which was fastened either to the shaft of the sewage pump or its drive motor. An overhead steel tank served as a reservoir for the oil and was connected to each gear pump by ⅜ in. copper tubing. Tubing of the same size connected the pump with the casing of the centrifugal pump at a point near its stationary wearing ring, Fig. 1.

That face of the ring, Fig. 2, which made contact with the pump casing was provided with a semi-circular annular groove which had a radius of ⅛ in. A ⅛ in. diameter hole was provided in the pump casing to permit the passage of oil from the copper tubing to the annular groove in the wearing ring. There were six ⅛ in. diameter holes, spaced equidistances apart in the wearing ring, which allowed the flow of oil from the annular groove to the space between the two wearing rings. These holes entered the space between the wearing rings at a point farthest removed from the suction eye of the impeller. This feature of design permitted the oil to pass over the entire surfaces of the wearing rings when the centrifugal pump was operating. A needle valve in the copper tubing was installed to control the quantity of oil being pumped to the wearing rings. There was also an overflow pipe from the oil pump through which excess oil was pumped back into the oil storage tank. Discarded automobile crankcase oil, was collected from city owned garages, was the lubricant used. The capacity of each oil pump was adjustable from a few drops per second to a little more than 1 gpm. After operating the rotary-type oil pumps for several months, they were found to be unsatisfactory and were replaced by bronze gear pumps, Fig. 3, which have given excellent service.

Each of the centrifugal pumps at the Dundalk and the Brooklyn sewage pumping stations was provided with its own oil pump. The former station is equipped with one 8,000, one 12,000, and one 14,000 gpm horizontal pump. The latter station contains two 3,000 and one 7,000 gpm pump. The Jones Falls pumping station is also provided with three horizontal centrifugal pumps, the largest of which has a capacity of 8,500 gpm and is equipped with an oil pump. All of the pumps discussed are horizontal centrifugal units with single-suction enclosed impellers. The suction inlet of each impeller was provided with a removable flat wearing ring. Adjacent to this wearing ring another one-piece wearing ring was fitted into the suction eye of each pump casing. The wearing

TABLE I.

Effect of Adding Oil between Wearing Rings of Centrifugal Pumps

Test	Method of oil application	Pump characteristics: Capacity	Total dynamic head	Speed	Test period: Beginning of test	End of test	Time elapsed	Sewage pumped	Wearing ring clearance: Beginning of test	End of test	Amount of wear	Wear per billion gal pumped
		gpm	ft	rpm			years	mil gal	in.	in.	in.	in.
1	Oil not used				Jan 15, '51	Mar 7, '58	7.14	6,760	0.015[1]	0.276	0.261	0.039
2	Gear pump				Nov 28, '59	Aug 15, '60	1.71	1,736	0.015	0.016	0.001	0.001
3	Rotary displacement pump	3,000	36	425	Apr 24, '58	Dec 28, '58	0.65	669	0.037	0.038	0.001	0.001
4	Gear pump				Dec 28, '58	July 28, '60	1.57	1,762	0.038	0.042	0.004	0.002
5	Oil not used	8,500	92.2	508-632	Apr 18, '55	May 27, '58	3.10	4,987	0.015[1]	0.162	0.147	0.029
6	Gear pump				June 17, '58	Aug 4, '60	2.13	5,466	0.015	0.020	0.005	0.001
7	Oil not used	8,000	106	706	Mar 12, '56	Feb 12, '59	2.92	4,225	0.015	0.188	0.044	0.001
8	Gear pump				Mar 11, '59	Aug 8, '60	1.41	3,469	0.015	0.020	0.203	0.005

1. Estimated

rings were originally made of bronze, containing 88 per cent copper, 8 per cent tin and 4 per cent zinc. After the clearance between the rings became excessive due to erosion, they were built up to their original thickness by the application of stainless steel, which had a Brinell hardness of 437. The speeds of the pumps, Table 1, varied from 425 to 706 rpm. All of the pumps operate under a suction lift. The sewage flow to each pumping station averages about 6 to 8 mgd and the quantity of oil used at each station varies from 30 to 40 gallons a week. The quantity of oil added to the sewage flowing to the two sewage-treatment plants which serve the city is very much less than 1 mg/l.

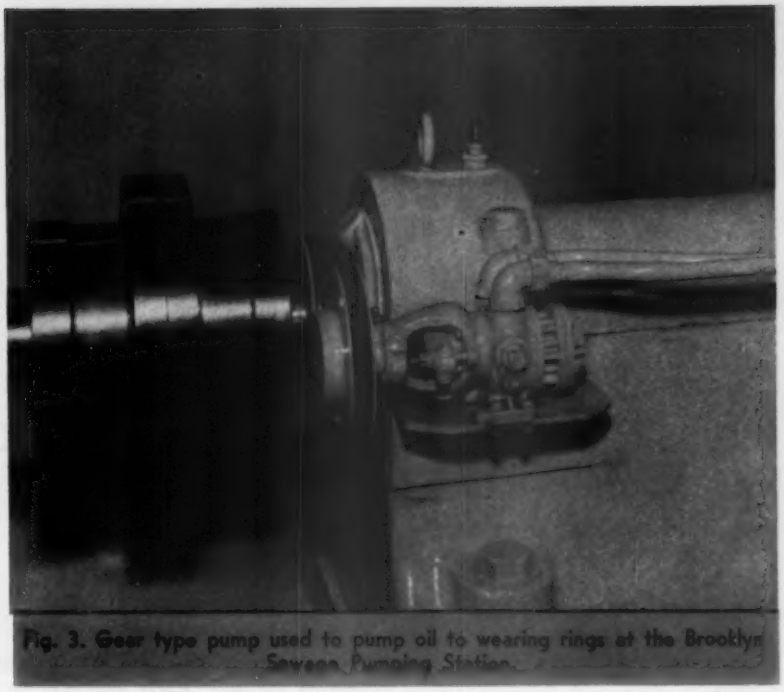


Fig. 3. Gear type pump used to pump oil to wearing rings at the Brooklyn Sewage Pumping Station.

Results

Eight tests were made over a period of 9¼ years at the Brooklyn, the Jones Falls and the Dundalk sewage pumping stations. Four tests were conducted at the Brooklyn station, two at the Jones Falls station and two at the Dundalk station. Tests were made using two pumps at the Brooklyn station and one pump at each of the other two stations. At each of the three stations one test was made to determine the extent to which the wearing rings were eroded when oil was not used, and five tests when oil was used. Table 1 gives the duration of each test, the quantity of sewage pumped during each test and the extent to which the wearing rings eroded.

Brooklyn Sewage Pumping Station

At the Brooklyn sewage pumping station the first test lasted from January 15, 1951, to March 7, 1958, when no lubrication was used. During this period of 7.14 years, 6,760 mil gal of sewage was pumped by one of the 3,000 gpm units, and the clearance between the wearing rings increased from 0.015 to 0.276 in. The rings wore at the rate of 0.039 in. per billion gallons of sewage pumped. The second test period, when oil was used, lasted for 1.71 years during which time 1,736 mil gal of sewage was pumped and the clearance between the wearing rings increased from 0.015 to 0.016 in. The wearing rings wore a negligible amount during this test. The third test using the second 3,000 gpm pump, lasted for 0.65 year from April 24 to December 28, 1958, during which time the rings wore at the rate of 0.001 in. per billion gallons of sewage pumped. At the end of Test 3, the use of a rotary-type displacement oil pump was discontinued and was replaced by a gear pump. Test 4 lasted for 1.57 years from December 28, 1958, to July 28, 1960, during which time 1,762 mil gal of sewage was pumped and the wearing rings wore at the rate of 0.002 in. per billion gallons of sewage pumped.

Jones Falls Sewage Pumping Station

The conditions at the Jones Falls sewage pumping station differ from those at the Brooklyn station in that the rate of discharge from the pump at the former station was more than twice that at the latter station. Furthermore, the total dynamic head was 92.2 ft as compared with 36 ft at the Brooklyn station. During the 3.10-year period from April 18, 1955, to May 27, 1958, when 4,987 mil gal of sewage was pumped and lubricating oil was not used, the clearance between the wearing rings increased from 0.015 to 0.162 in. or 0.147 in. The wear per billion gallons of sewage pumped was 0.029 in. The wearing rings were made of government bronze that had been subjected to considerable wear but which had been restored to their original dimensions by the application of stainless steel. The foregoing rate of wear to the wearing rings was considerably less than at the other two pumping stations when bronze pump rings were used and oil was not applied. The reason for there being less wear at the Jones Falls station was that the stainless steel rings were much harder than the bronze rings.

From June 17, 1958, to August 4, 1960, oil was applied to the wearing rings by means of a gear-type pump. During this period 5,466 mil gal of sewage was pumped and the clearance between the wearing rings increased from 0.015 to 0.020 in. The wear amounted to 0.001 in. per billion gallons of sewage pumped.

Dundalk Sewage Pumping Station

The experience at the Dundalk pumping station was similar to that at the other two stations. At this station observations were made using an 8,000 gpm centrifugal pump which operated against a total dynamic head of 106 ft. The pump was operated first for 2.92 years during which time no lubricant was used. During this period the clearance between the wearing rings, which were made of bronze, increased from 0.015 to 0.203 in. at a rate of 0.044 in. per billion gallons of sewage pumped. The rings were then metalized with stainless steel to restore the clear-

ance to 0.015 in. The pump was then operated for 1.41 years during which time oil was applied to the rings and 3,469 mil gal of sewage was pumped. The clearance between the rings increased from 0.015 to 0.020 in. or at the rate of 0.001 in. per billion gallons of sewage pumped.

Discussion and Conclusions

The observations made at the three pumping stations, which are equipped with centrifugal pumps, ranging in capacity from 3,000 to 8,500 gpm and which operate at speeds varying from 425 to 706 rpm indicated that the clearance between the wearing rings increased at the rate of 0.029 to 0.044 in. per bil gal of sewage pumped when lubricant was not added to the wearing rings. When lubricating oil was used the clearance between the wearing rings increased at the rate of approximately 0.001 to 0.002 in. per bil gal of sewage pumped. It is apparent that the use of spent lubricating oil has greatly reduced the wear of the wearing rings. The ultimate result has been that the cost of replacing worn out wearing rings or metalizing them to restore their original clearance has been considerably reduced and the efficiency of the pumps has been increased since less sewage flows between the wearing rings from the high to the low pressure side the pump impellers. This improvement in operation was accomplished at a minimum cost. Providing the Brooklyn pumping station, which has three centrifugal sewage pumps, with oil pumps, an oil storage tank, piping, etc., cost approximately $500. The cost of the power to operate the oil pumps is negligible, and the spent oil that is used is obtained gratis.

Deep Wells Developed for Land Reclamation Project

More than 1,000 vertical turbine pumps are being used for a reclamation project of record size being launched in Pakistan. The project will halt a ruinous soil condition which is threatening West Pakistan's food supply.

The drilling, developing and equipping of 1,000 deep wells will reclaim land already lost due to the encroachment of salt and will arrest further land loss. This condition has already affected half of the country's arable farm land and is ruining an additional 100,000 acres annually. The area which will be covered by the project consists of about 1.6 million acres lying between the four branches of the Indus River to the south of Lahore.

The $9 million project is being undertaken by the engineering and contracting firm of Harold T. Smith International, S. A. Contracts for the job were awarded Smith by the West Pakistan Water and Power Development Authority and are being financed largely through a U. S. Development Loan Fund basic economic development loan to Pakistan.

The salinity problem which Smith and his crews solved was caused by the exceptionally high underground water level found in most of the Punjab area of West Pakistan. In many places ground water is within a foot or less of the surface.

Because the water level is so high, moisture works its way up through the soil to the surface, where it is evaporated by the intense summer heat—over 100° F for continued periods. As the water evaporates, it leaves behind deposits of mineral salts. These salts gradually build up to the point where the concentration is so high that the soil can no longer support plant life.

The deep wells will be used to lower the high water table, thus stopping the upward movement of water through the soil. Each well will be equipped with a Worthington Corp. vertical turbine pump to withdraw water from below the ground and pump it into irrigation canals. The canals will take the water to other areas where the water table is at a normal depth and where irrigation is needed.

The government contract specifies that the 1000 wells be completed within 23 months. However, because of mobilization time and due to the monsoon season (during which much of the area will be flooded) actual working time will be reduced to 15 months.

Checking the advance of the soil blight will solve one of Pakistan's most pressing social-economic problems. Because so much productive land has already been lost, the country is being forced to import ever increasing quantities of food stuffs to feed its rapidly growing population. This is seriously draining the country's foreign exchange and is delaying other development plans aimed at overall economic development.

Surveys indicate that the well drilling program will directly benefit 1.4 million acres of land with fringe benefits extending to an additional million acres. The program is expected to eventually raise annual food production by 800,000 tons.

The high water table is also causing severe water-logging of much of the land. Not only does this rot the roots of plants but it also results in ruined roads and even the collapse of masonry buildings.

Measured in human terms, villagers and farmers by the tens of thousands roam the country side looking for new, fertile areas in which to grow their crops. Abandoned farms and villages dot the landscape in every direction. In many places the barren earth is white with salt. In other places the underground water has risen to the point where it is actually above the surface.

There is nothing new about salt accumulations ruining fertile fields. Exactly the same problem is said to have wiped out the great civilization ot the Tigres-Euphrates Rivers in the 13th Century after more than 1,800 years of flourishing prosperity. The demise of the extensive and rich Pima Indian culture of Arizona in the Southwestern U. S. is also attributed to the accumulation of salt in the soil.

Terms of the contract cover drilling, developing and testing of the tube-wells; furnishing and installation of steel pipe, gravel shrouding, pump motors, discharge pipes, electric motor controls including watthour meters and construction of permanent pump houses.

The majority of the wells will be sunk near existing canals and other irrigation water supplies. Capacity of the individual wells will be determined on the basis of the maximum cultivable area under their command.

The earth through which the boreholes are to be sunk is made up of medium grain sand, silts and clays with the entire formation interspersed with occasional layers of finer silts and clays.

DISPATCHER Vince DiRamando, with record book on desk, radios order to service truck.

Two-Way Radio Is Johnny-On-The-Spot

by WILLIAM MAHONEY, Motorola, Inc.,
Technical Information Center
Communications and Industrial
Electronics Division, Chicago, Ill.

■ GIVING THE BEST possible service at the lowest possible cost can become quite a task for a water department when there are nearly 900,000 customers. For this reason, the Water Division of the City of St. Louis has incorporated two-way mobile radios into its service operations. The Division has installed Motorola mobile radios in 34 vehicles, four in cars of supervisors, six in inspector's vehicles, and 24 in maintenance trucks and equipment.

SERVICE TRUCK DRIVER receives orders from dispatcher as crew installs valve.

The result, Water Commissioner Conway B. Briscoe, reports has been a marked increase in productivity. "If we didn't have radio", says Briscoe, "more trucks and more men would be needed to handle our work load". Making possible the productivity gains is the pinpoint coordination that is achieved by radio. The minute a foreman discovers additional material will be needed on a job, he's "on his radio". Radioing in advance, the material is at the job by the time it is needed, minimizing if not entirely eliminating any delays. Without the radio system, an entire crew would be idled while the foreman made contact with the office and the office located a truck to make the delivery.

This fast dispatching technique is also a vital link used by the Division for providing special equipment on jobs. When a piece of equipment

SMITH CHECKS with office before heading to a construction site.

ANTENNA shows at top of water tower.

breaks down, radio is utilized to bring the nearest service truck. The supervisor on the job radios the dispatcher who determines which serviceman is nearest the location. This man is dispatched. Two savings result: the job is idled only a short time and the Division saves vehicle expenses by dispatching the closest truck.

In the area of supervision, radio plays an equally important role. Supervisors are never "lost" to the company. Should one be suddenly needed to solve a problem at a job site, he can be reached in seconds by radio. The solution can be given over the radio or the supervisor can be dispatched to the trouble area.

Dispatching vehicles directly to jobs saves the Division vehicle operating expenses since mileage is reduced. Many unnecessary trips are eliminated by rerouting trucks, dispatching the closest service vehicle, and by providing answers to problems via radio. In fact, it is estimated that the Division realizes an annual saving of $2,500 on gasoline costs alone.

Quick freezes, floods and other disasters place special demands on the water department of any city, and St. Louis is no exception. When a phone call is received that water is pouring onto a street or into a building, the dispatcher radios the nearest repair crew. The crew can be on the job in 15 minutes. Without radio, it might take an hour to locate and dispatch a crew. In emergencies, repair crews can radio the engineering staff for immediate information on procedures. The engineers can read their drawings to the crew and promptly direct them to water cut-off points.

The Division originally installed a two-way radio system in 1956. These were tube-type units. In the fall of 1959, the Division switched to the new, extensively transistorized Motrac* radio units. These radios have been on the market only since the beginning of 1959. Provided in the new transistor radios are extra benefits which reduce vehicle operating expenses. These are high reliability and low power consumption characteristics. The new radios have proved so much less expensive to operate than conventional units that installation of additional units is being planned.

SMITH RECEIVES emergency call on radio while inspecting a construction site.

The savings are realized through the extensive use of transistors. Both the power supply and receiver of each mobile unit are completely transistorized. Savings have been made possible through longer battery life, lower maintenance costs on spark plugs and points and through reductions in gasoline consumption.

An example of battery savings was demonstrated by William Smith, Commissioner Briscoe's administrative assistant. Smith tested the transistorized equipment by leaving the unit in his car turned on for an entire day. That evening, when he went to start his car, it "kicked right over". Smith estimates that the City can save at least $500 a year in battery and maintenance costs through use of the transistorized radios.

Maintenance costs are lower because transistors, which are solid state, non-moving devices, have replaced tubes. Expected life of the transistors is equal to that of the radio unit, while tubes usually last no longer than two years. In addition, maintenance rates are about 10 per cent less than rates on vibrator radios. All maintenance of the Division's radio equipment is handled under a subcontract with the manufacturer by an authorized service organization in St. Louis. This group provides regular preventive maintenance and gives fast service on breakdowns.

Gasoline costs are reduced because it is not necessary to idle the vehicle's engine in order to monitor the radio. This is because the new equipment draws very little power from the battery. With conventional tube-type radios, it would be necessary to idle the engine for monitoring, thus raising gasoline costs. A second saving is the elimination of the need for frequent engine overhauls, brought about by prolonged idling when tube-

WATER COMMISSIONER Conway B. Briscoe, left, and Administrative Assistant William Smith study a map showing locations of St. Louis water mains.

*Product of Motorola Communications and Electronics, Inc., Chicago, Ill.

type radios are used.

Before the Division switched to the new transistorized radios, batteries frequently went dead and at very critical times. Now battery problems have been drastically reduced since power consumption is so low. The City Water Division has set up its two-way radio base station at Compton Hills Reservoir where Dispatcher Vince DiRamando can be in instant contact with any radio-equipped vehicle on the Division's frequency. To cover the greater St. Louis area, the Division has established three additional remotely controlled dispatching points, the Kings Highway General Office, the City Pipe Yard and the Lighting Division yard.

The Division has also taken advantage of a system that alerts drivers they are wanted on the radio by sounding the horn in their vehicle. This Selective Signaling System enables drivers to leave their trucks to handle other duties without being out of contact with headquarters. Commented Dispatcher DiRamando, "we can't afford to have our maintenance men sitting around in trucks waiting to receive messages".

The value of radio for the St. Louis Water Department was aptly summed up by one of its engineers, "when an emergency comes up, two-way radio is Johnny-on-the-spot".

MSD Receives Sewer Service Rates

The Board of Trustees of the Metropolitan Sewer District has adopted a revised and reduced sewer service charge rate. The new annual service charge rate for a private home is $4.00 per year. The rate is $4.60 a year if not paid within 15 days of the mailing date of the statement. Last year, the annual net rate was $6.80, or $8.00 if not paid within the discount period.

In previous years, service charge bills were mailed twice a year. Under the new revisions, bills will be mailed once a year.

These service charges are in addition to the four cent tax rate per $100 valuation on all taxable, tangible property, which the Board adopted last May. Hearings on this sewer tax were held in April and May in three public meetings for municipal officials, industry, and the general public before the Board formally adopted the tax measure.

The Board also approved two changes in the sewer service charge system for private homes that discharge sewage into septic tanks. In the past, everyone had to pay the service charge. Under the new revisions, the service charge is not applicable to owners of individual septic tanks completely on their own property.

Homes connected to community or subdivision septic tanks will continue to pay the sewer service charge because sewage from these tanks is discharged through facilities managed and maintained by the Metropolitan Sewer District.

Persons who live in an apartment or flat, and have an individual water meter, will pay a sewer service charge of $3.00 per year per unit. If not paid within 15 days of the mailing date of the statement, the rate will be increased to $3.45 per year per unit.

Industry and commercial establishments will pay for sewer service according to the amount of water they use which becomes sewage and finds its way into the public sewers serving the property. These large users of sewer facilities will be billed twice a year, figured on the previous six months water use.

Annual Report, Philadelphia Water Department, 1959

Philadelphians consumed an average of 343.5 million gallons of water daily in 1959, compared with 336.6 million gallons in 1958. The maximum daily consumption was 481.7 million gallons, according to the Philadelphia Water Department's Annual Report for 1959.

The year 1959 saw the new Torresdale Water Treatment Plant, largest push-button water works of its kind in the country, open its doors after five years of building and the investment of $25 million.

The sewage treatment system handled a record daily average of 317 million gallons of raw sewage in 1959, as the Water Department pressed forward with construction of interceptor sewers to end by 1963 the last dumping of raw sewage into the rivers.

Thomas W. McCreary Dies

Thomas W. McCreary died on January 3, in Birmingham, Alabama just two weeks following the death of his wife. Southern Sales Manager of United States Pipe and Foundry Company at the time of his retirement in 1959, Mr. McCreary had been connected with the Birmingham Office since 1920 and with U. S. Pipe since 1912.

Hong Kong's Water Program

Hong Kong is probably the most populous place on earth with an almost unsolvable water problem. Its ever-growing population and developing industries have, since the war, regularly outstripped the capacity of new reservoirs even before their actual completion.

For a century now there has been a constant struggle to keep pace with water demands, because, in the absence of any large rivers or underground water resources, Hong Kong is entirely dependent on the annual rainfall, mainly confined to the summer monsoon period.

There are now 14 reservoirs on the island, having a total capacity of 10½ million gallons, yet it is necessary to ration water supplies all the year. The large Tai Lam Ching reservoir was completed in 1957, but its full benefit will not be felt until 24 miles of associated catchwater channels come into operation next year.

Work is now in progress on the Shek Pik reservoir scheme, costing an estimated $28 million, which, by 1963, will bring water to the city from Lanta island. Its completion will increase the total existing water storage by 50 per cent. An interesting feature of this scheme, planned by London consulting engineers, Binnie, Deacon and Gourley, is the laying of eight miles of 30 in. pipeline on the seabed.

Even when the Shek Pik scheme is completed, the demand for water will still exceed the supply. The latest and most promising water conservation scheme is an inter-linked plan to convert two sea areas, at Plover Cove and Hebe Haven, into fresh water reservoirs.

AWWA Directors Meet

HURST

ORCHARD

■ NOMINATIONS FOR the office of president, vice-president and treasurer were made by the AWWA Board of Directors which met late in January.

John W. Cramer, senior partner in the consulting engineering firm of Fulton & Cramer, Lincoln, Neb., was nominated president.

A registered professional engineer in Colorado, Idaho, Iowa, Kansas, Missouri, Nebraska and South Dakota, Cramer received his degree in civil engineering from the University of Nebraska in 1940. He has been a member of the Association since 1948 and served as secretary of the Nebraska Section from that time until 1951. He represented his section for three years on the AWWA's Board of Directors.

In 1954, Cramer was awarded the Association's George Warren Fuller Award for outstanding service in the field of public water supply.

Nominated vice-president was William D. Hurst, city engineer and chairman of commissioners of the Greater Winnipeg Water and Sanitary Districts, Winnipeg, Man. Hurst was graduated from the University of Manitoba in 1930 and has been a member of the AWWA since 1934.

Hurst has been awarded the Association's George Warren Fuller Award for outstanding service.

William J. Orchard of Maplewood, N. J., was nominated treasurer. Retired general manager of Wallace & Tiernan Inc., Belleville, N. J., Orchard has been a member of the AWWA since 1917 and is completing his fourth term as treasurer.

In 1954 Orchard was awarded the John M. Diven Medal for rendering the most outstanding service to the Association. He received the Harry E. Jordan Achievement Award in 1956 for distinguished public service outside the line of duty.

Aims and Objectives

The Board approved expanding the Association's activities, particularly in the fields of education and research in agreeing with the recommendations of the Aims and Objectives Committee.

President Wertz was authorized to appoint a committee to be charged with employing a management consultant and working with him and the staff in laying out a program to accomplish the recommended expansion and to finance it.

Standards

The Board accepted a recommendation to discontinue efforts to establish a program for the present and approved a plan to increase the Association's efforts to improve and enlarge the scope of present standards. The decision to establish a service through which a full set of standards can be provided to members and be kept up to date for them was based on the Certification Policy Committee's report of the continuing legal and practical obstacles to a useful certification program.

The Board approved AWWA membership in the International Water Supply Association, approved a budget of $550,000 for 1961 and took care of other necessary business.

Staff Reorganization

Eric F. Johnson, assistant secretary and director of publications, was placed in charge of the Advancement Program. He will continue to be responsible for publications activities as well as some administrative matters. Taking over most of the duties in the publications field will be Lawrence Farber, who will move up from managing editor to assistant director of publications. Arne Gubrud, associate editor, has been appointed assistant director of advancement.

As part of the general reorganization, Robert A. Nye, publications production manager, is moving up to the newly established position of manager of membership services.

AWWA Awards

Annual awards to be presented at the Detroit Confer-

CRAMER

JOHNSON

ence were announced by the Board as follows:

Honorary memberships were presented to four men: Ray L. Derby, principal sanitary engineer, Los Angeles Department of Water & Power; Otto C. Eckert, general manager of the Lansing (Mich.) Board of Water & Electric Light Commissioners; Attmore E. Griffin, treatment consultant, Pompton Plains, N. J.; and Fred Merryfield, professor of sanitary engineering at Oregon State College.

The Diven Metal was awarded to Lewis S. Finch, vice-president and chief engineer, Indianapolis (Ind.) Water Co.

The 1960 Publications Award was presented to Claud Erickson, mechanical engineer, Lansing (Mich.) of Water & Light, for his paper "Submersible Well Pumps," (AWWA Journal, September 1960).

Division awards were made for AWWA Journal papers in four categories. They were:

Distribution Division—Robert F. McCauley for his paper "Use of Polyphosphates for Developing Protective Calcite Coatings" (June 1960).

Management Division—William R. Seeger, for his paper "Duties and Responsibilities of the Water Utilty Manager" (September 1960).

Purification Division—Jonathon L. Tuepker and Herbert O. Hartung, for their paper "Effect of Accumulated Lime-Softening Slurry on Magnesium Reduction" (January 1960).

Resources Division—Louis Koenig, for his paper "Survey and Analysis of Well Stimulation Performance" (March 1960).

Professor Philip Morgan Dies

Professor Philip F. Morgan, a member of The State University of Iowa engineering faculty since 1948 and mayor of Iowa City during 1959, died January 19, at University Hospitals of a chronic kidney ailment.

A professor of sanitary engineering, Morgan was the recipient of several honors presented by professional associations. He twice received the Radebaugh Award from the Central States Sewage and Industrial Waste Association, at Indianapolis in 1951 and at Rochester, Minn., in 1955. The following year he received the ASCE Research Award at its national convention in Dallas, Tex.

He was president of the Iowa Section of ASCE in 1953 and president of the Iowa Section of the American Water Works Association in 1957. He had also served on the board of direction of the Iowa Engineering Society.

He joined the staff of the Chicago Pump Company in 1935 and became manager of their Sewage Equipment Engineering Department in 1941. In 1946, he became a fellow at the Mellon Institute of Industrial Research directing a National Council for Stream Improvement project at Kalamazoo, Mich.

He had served as development engineer in charge of pilot waste-treatment plants at Fitchburg, Mass., and the Terre Haute (Ind.) Paper Company, as well as consultant for several other firms, before joining the SUI faculty. In the school's civil engineering department Professor Morgan taught classes in water purification and sewage disposal and sanitary engineering, fields in which he has been the author of some 20 technical articles and other publications.

Besides the ASCE, he held memberships in the Central States and Iowa Sewage Works Associations and the Iowa Engineering Society.

Milligan Retires from Penn. Health Dept.

Francis B. Milligan, for 15 years chief of the industrial wastes section of the Pennsylvania Department of Health, retired recently, completing 33 years of service with the Department.

Dr. C. L. Wilbar, Jr., State Health Secretary, complemented Mr. Milligan for his "long period of continuous, devoted performance of duty." Fellow employes gave a farewell party in his honor earlier this month.

Mr. Milligan, a native of Philadelphia and a long-time resident of Harrisburg, joined the State Health Department in 1927 as an employe of the Sanitary Engineering Division. His work included research on industrial wastes, experimental plants for treatment of tannery and paper mill wastes, river studies and pollution control measures.

In 1945 he was appointed chief of the industrial wastes section. He has participated in the development and application of Sanitary Water Board policies on stream classification and effluent requirements and has worked with industry committees on formulating industrial waste standards.

From 1920 to 1927, Mr. Milligan was employed with consulting engineering firms in Philadelphia, New York and New Jersey on flood control projects, surveys, roads, buildings, sewage disposal, estimates and reports. He plans to become engaged in consultive engineering work, but hopes to find some time for his favorite sport of sailing.

Editorial

AWWA Directors Consider Aims and Objectives

Several significant steps were taken during the annual AWWA Board of Directors' late January meeting in New York City. At least the available information indicates that something more than routine items were covered. To begin with, a whopping half million plus budget for 1961 was passed to help bring into realization some of the projects requiring financial support.

We don't know specifically what budget allocations are, or will be, made, but one potentially valuable move was made which could in the long run be considered an investment. We refer to the detailing of a group under C. F. Wertz and Sam Baxter to hire a management consultant to study AWWA and make recommendations for future operation. Of course, it is one thing to seek and obtain competent consultative help, but quite another to accept and implement the findings. Apparently, considerable latitude outside the Board proper was given to permit expeditious locating and hiring a consultant. It is hoped that this latter job can be completed and that he can be at work before annual conference time in June. Provided he is permitted to enjoy investigative freedom and allowed to complete his study without bias, AWWA can consider the financial aspect an investment. Whether it can be realistically an investment, though, depends on AWWA's subsequent treatment of the final report.

The Board also received the final report of the Aims and Objectives Committee. Not too much information about their action on this overwhelmingly huge undertaking has been released. One thing was announced, however. A committee was appointed to implement, at least partially, the recommendations of the A and O committee. As has been pointed out here earlier, (W&SW, Aug. 1960) several organizational questions made difficult the establishment of the recommended full-fledged research organization, supported partially by, but separate from, AWWA. It is apparent that political expediency caused dilution of the research sub-committee's major proposal in favor of a hesitating half-step, instead of a positive full-step, into a full-fledged research program.

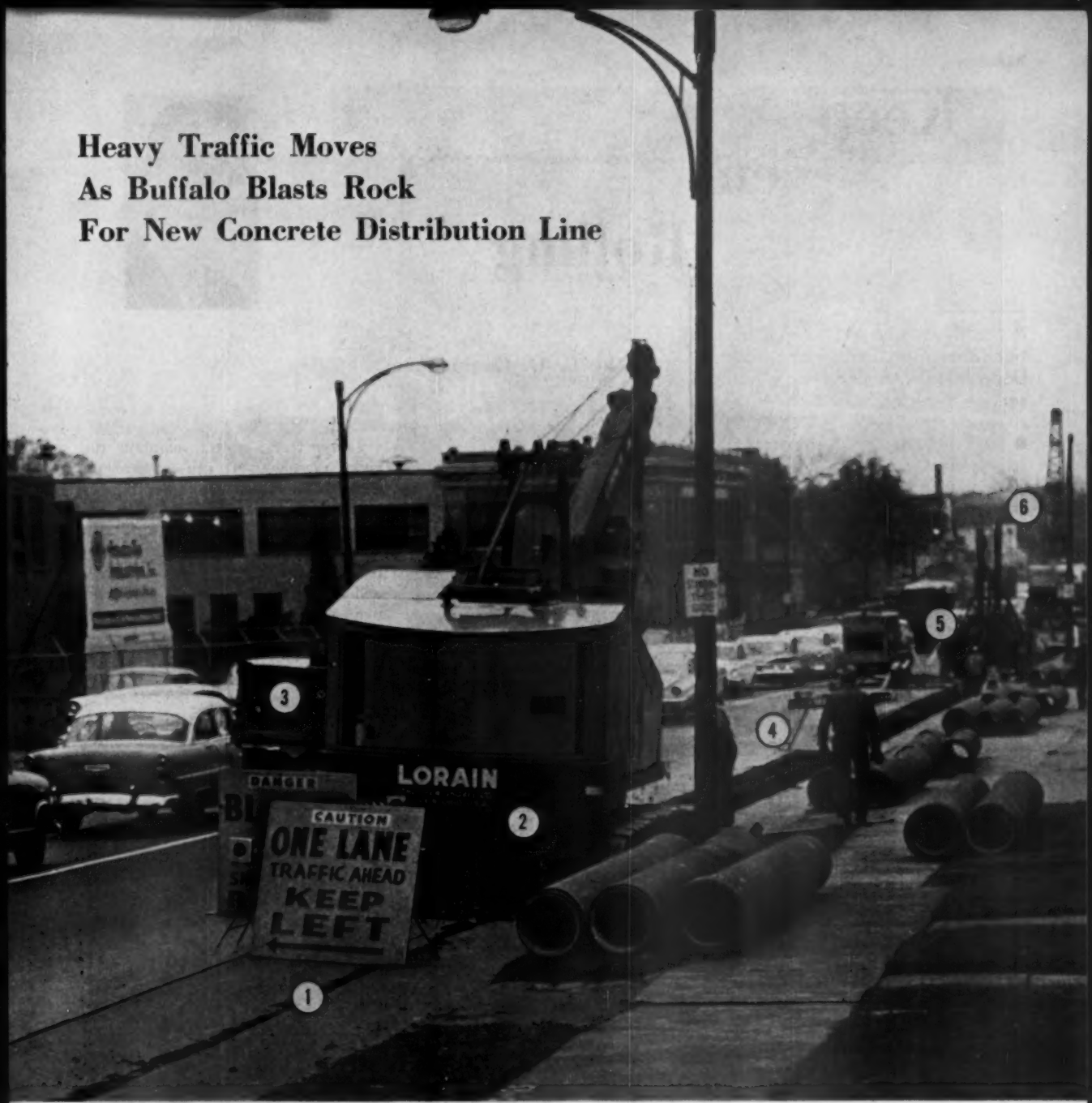
An Award and a Puzzlement

We were more than pleased to note that the distribution division's award for the best journal paper in 1960 went to R. F. McCauley for his report on calcite coating for water mains. This work, involving as its does, recognition of the fundamental aspects of chemical equilibrium and velocity, is of tremendous importance. It is so important because Dr. McCauley has provided interpretations which permit application of the pipe protection system by anyone capable of rudimentary water sample analysis. Developments of this type do not occur often, and it is to the credit of AWWA and the USPHS that they teamed together early in recognizing the value and support of this program.

Substantial publicity, both within the field and in the public press, has been given to the McCauley findings, but as yet only minor interest has been shown by chemists and engineers in establishing field trials. It is certain that future technicians will recognize the value of the method in preventing distribution system deterioration. They will also wonder why more supplies did not readily adopt the practical procedure when it was made available. This, as Siam's fictional king says, is a "puzzlement."

V. W. Langworthy

Heavy Traffic Moves As Buffalo Blasts Rock For New Concrete Distribution Line



East Delavan Avenue in Buffalo gets a lot of traffic on weekdays, and tie-ups were expected when a new 16-inch water distribution line was planned for this street.

But contractor Theodore Bieniek of Eggertsville, N. Y., ran a smooth operation that kept traffic moving at a good pace even while he was blasting through 5 to 6 feet of rock.

It worked like this: Workmen scored asphalt pavement (1), backhoe (2) excavated to rock and loaded truck (3). Working area (4) was kept completely free of refuse and excavated material. Drilling rig (5) drilled rock for dynamite, and truck crane (6) with a clam shell bucket handled the heavy blasting mats, and removed the loose rock.

Following the placing of a sand bed, the installation of the concrete pipe moved at high speed.

Prestressed concrete steel-cylinder pipe was used on this distribution line because it offers long life, continued high capacity, and has the extra strength to take the pounding of heavy traffic.

James N. DeSerio was Consulting Engineer for the project. Francis Downing is Commissioner of Public Works and Frank Szuniewicz, Jr. is Director of Water for the City of Buffalo. The pipe was manufactured by Price Brothers Company with Headquarter Plants in Hattiesburg, Miss., and Dayton, Ohio.

Price Brothers
CONCRETE PRESSURE PIPE

Keep 'em Rolling

A monthly memo providing practical advice on the care of your Department's maintenance and service vehicles.

by C. G. Cunningham

■ ONE OF THE MOST DANGEROUS jobs around trucks is demounting and inflating the tires your water and sewage trucks ride on. For years it was the sledge hammer and wedge approach (Figure A) to get the locking rings unlocked.

Figure A

Recently several new and safer methods have been brought out to help cut down the accident toll, and to make the job easier. One is "Break-Safe", shown in Figure B.

It is designed to break the bead without damaging the sidewalls, cutting the bead or producing dented or sprung rims and wheels. It also protects the operator from a flying locking ring during the first pressuring, as illustrated in Figures C and D.

A water department man driving in a residential street in San Diego was hit broadside by a teen-ager driving an older sedan. The sedan was doing 80 in second when it collided with the pick-up. The water department man was wearing the required seat belt. He crawled out of the wreck without a scratch. Seat belts are standard equipment in all San Diego city-owned vehicles and *must* be worn.

Figure B

Tracks that are too tight or too loose on your track rigs can cause big problems.

Figure C

Loose tracks won't maintain the right alignment. It causes wear on the sides of roller and idler flanges as well as wear on the sides of links and bushings. The track also tends to come off when the tractor is turned. At high speeds, the track will whip, and that means more load than normal on carrier rollers and their support brackets.

Tracks too tight are just as bad. Not only do tight tracks rob your rig of its horsepower, but all components go under a too high strain. This means wear—unnecessary wear. If your tracks are very tight, it can lead to making them run hot and damage the hardness of the pins and bushings. When this hardness goes,

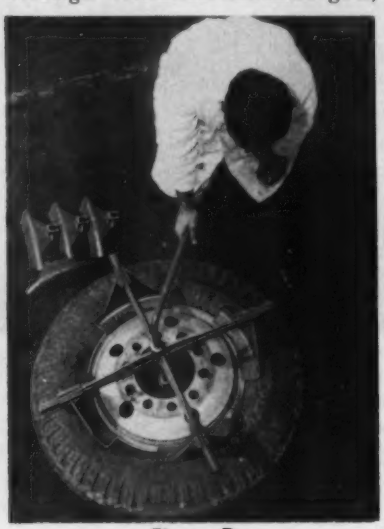
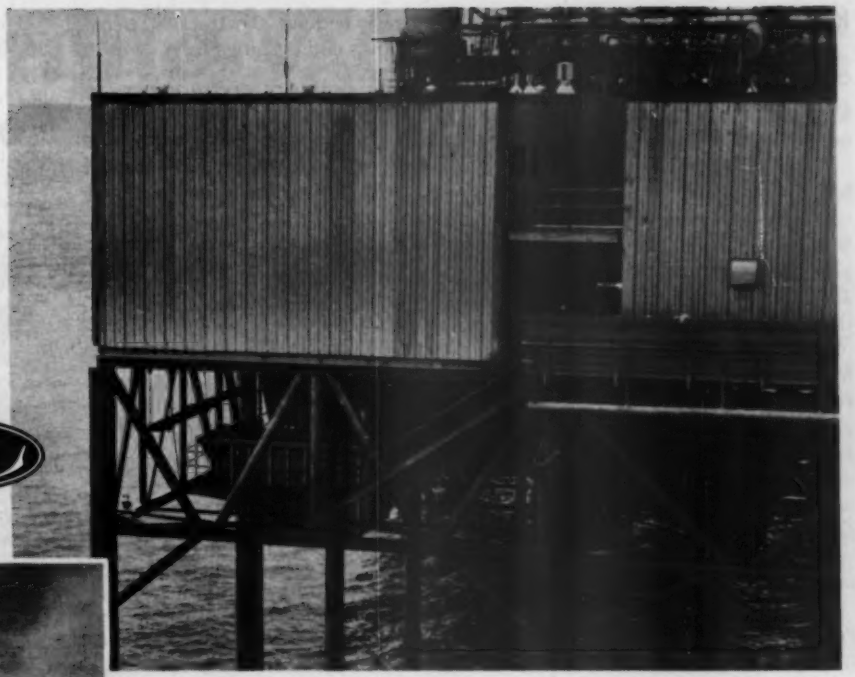


Figure D

the wear rate accelerates and big repair bills follow close behind.

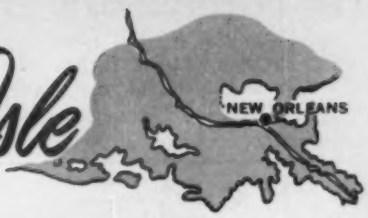
A crawler track functions closely with the rest of the tractor, so the other parts are affected by tight tracks. These include the final drive gears, hubs and bearings. For the

CONTINUED ON PAGE 90A



FREEPORT SULPHUR MINE is the world's most unusual mining operation. The above photograph shows the giant water heating plant (left), the hotel-office structure and heliport (center) and the bleedwater platform (background). The sulphur drilling platform with its connecting freeway is pictured below.

Grand Isle



A Smith & Loveless "Oxigest" factory-built sewage treatment plant serves the fabulous Freeport Sulphur Mine located seven miles out in the Gulf of Mexico, off Grand Isle, Louisiana. This unusual treatment plant installation is a 6,000-gallon unit, engineered to serve the disposal needs of the 100-man working force on Freeport's man-made steel island, the world's first off-shore sulphur mining operation.

The Freeport "Oxigest" was shipped by truck from the Smith & Loveless manufacturing plant to Orange, Texas, where it was bolted in place below the superstructure which houses the hotel and office building. Then, the stilt-like structure was floated by barge to the mine site, lifted by huge cranes and set into place, some 60 feet above the Gulf surface.

We, at Smith & Loveless, are proud to count the sewage treatment plant at the Freeport Sulphur Mine among our many "Oxigest" installations.

For more information on Smith & Loveless "OXIGEST" write Department 20.

Smith & Loveless

ONE OF THE UNION TANK CAR COMPANIES

P. O. BOX 8884/KANSAS CITY 15, MISSOURI/PLANT: LENEXA, KANSAS

(2833)

Keep 'Em Rolling

CONTINUED FROM PAGE 88A

final argument, tight tracks cut down on the work your rig can do.

When side wear on track assemblies has started, it can be stopped in a hurry by switching track assemblies. But if the side wear is severe, also switch the rollers, idlers and sprockets to the other side of the rig.

Wear on pins and bushings close to the master pin can usually be reduced if you replace the master pin periodically. This is a good idea anyway since the master pin tends to wear faster than other pins and bushings because they have less contact area.

If pins and bushings are not worn beyond recommended limits and are not cracked, do this: Turn them 180 degrees after the track has been adjusted to take up as much slack as possible and is still too loose.

This turning gives the pins and bushings a new wearing surface because they wear both on the inside and the outside. Of course, when you turn the pins, you also "shorten" the track because the track stretches as the pins and bushings wear.

Check your tire pressure regularly? Fleet cars with tires under-inflated five pounds can cost you half a gallon of gas out of every twenty you burn. Dirty air filters will rob you of another 10 per cent of your mileage per gallon.

Is the brake fluid in your trucks and fleet cars turning them into death traps?

It is not only possible, but probable, because today only 28 states have *any* type of legislation against the sale of sub-standard brake fluid. And many of these laws have no teeth in them.

How about your state? Those that have laws that at least try to restrict the sale of bad fluids are: Alaska, Alabama, Arkansas, California, Oklahoma, Pennsylvania, Connecticut, Delaware, District of Columbia, Florida, Georgia, Louisiana, Maine, Minnesota, Mississippi, New Jersey, New York, North Carolina, South Carolina, Tennessee, Texas, Virginia, Wisconsin, Rhode Island, Massachusetts, Kentucky, Arizona and Michigan.

The biggest problem with substandard fluids is a low boiling point. The brakes heat up, the fluid boils and vaporizes. As a vapor it can be compressed and you have no braking action. Then after the wreck when the cause is being hunted, the vapor has cooled and condensed and is back in fluid form again. Now the brakes work fine.

Chrysler Corporation engineers made a test in Detroit recently and found that 28 per cent of the brake fluids sold there were unsafe! Of the 75 brands tested, 15 were found to be so substandard they would not pass any of the SAE rating formulas. And those that were below par were worse this time than when investigated five years ago.

There are three types of SAE approved brake fluid: SAE 70 with "R-1", "R-2" and "R-3" endings. The R-3 fluid has the highest boiling point. Take a look at your fluid supply. Is it up to standard? Does it have the "SAE 70-R-2" approved label? And are you sure that it is made by a reputable maker. Remember there are 70 makes of inferior fluids on the market—all phantom killers!

YOU CAN'T BE TOO CAREFUL WITH CHEMICALS

Because most workmen are careful and respectful of potentially hazardous chemicals, accidents don't often happen.

You don't have to handle chlorine cylinders quite this way, but don't let *your* men become complacent. Keep those safety posters out where they are a constant reminder of the correct ways to do things.

If you'd like an additional supply of posters showing the best ways to handle chlorine, let us know. We'd also like to send you a copy of our 76-page chlorine manual. Ask for it.

HOOKER CHEMICAL CORPORATION
1703 UNION STREET
NIAGARA FALLS, N.Y.

HOOKER CHEMICALS PLASTICS

Sales Offices: Buffalo, Chicago, Detroit, Los Angeles, New York, Niagara Falls, Philadelphia, Tacoma, Worcester, Mass.

In Canada: Hooker Chemicals Limited. North Vancouver, B. C.

LimiTorque VALVE CONTROLS
help operate "The 8th Wonder of the World"

COVINA PRESSURE REGULATING STRUCTURE
. . . one of several such structures in a distribution system supplying water to 7,500,000 people in 91 cities

Be sure to send for Bulletins #1-60 and #19-60 which illustrate and describe the construction, operation and installation of LimiTorque.

This huge water system, selected by the American Society of Civil Engineers as one of the "Engineering Wonders of the World" and operated by the Metropolitan Water District of Southern California, supplies water to 7,500,000 people in 91 incorporated cities over an area of 3,400 square miles in six counties . . . It was built at a cost of approximately $400,000,000 and has the capacity to deliver 1,212,000 acre-feet of water annually. Its intake is on Lake Havasu formed by Parker Dam on the Colorado River, 300 miles from the City of Los Angeles. Many hundreds of LimiTorque Operators are used on all types of Gate, Globe, Butterfly, Plug and Cone Valves throughout this tremendous water system . . . Twenty-two LimiTorque Valve Controls alone are used in this Pressure Regulating Structure, for operating Plug and Cone Valves made by well-known manufacturers.

LimiTorque Operators were chosen because of their accuracy, safety, absolute dependability, and ease of push-button control from local or remote locations.

For specific applications, consult your valve manufacturer or nearest LimiTorque Sales-Engineering Office.

THERE IS NO SUBSTITUTE FOR —

LimiTorque®

PHILADELPHIA GEAR CORPORATION
KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
Limitorque Corporation • King of Prussia, Penna.

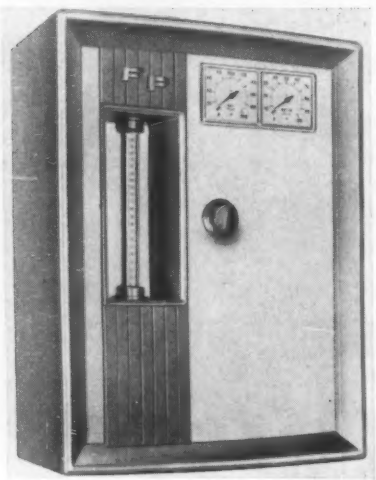
EQUIPMENT IN THE NEWS

For further information on products or services please use reader service card.

Wall Mounted Chlorinator

301

Fischer and Porter Co., Warminster, Pa., have developed a manually-operated chlorinator that has an accuracy of ± 2% feed rate over a 20 to 1 range in flow. All control components are enclosed in a Safety stack regulator, and the chlorinator is housed in a rigid fiberglass cabinet for complete protection against corrosion.



Features of the Safety Stack design are: a shut-off valve which seals the chlorine supply from the chlorinator during inoperative periods; an isolating valve which seals tight the functional parts of the Safety Stack and prevents even traces of water from entering the chlorinator due to ejector back pressure; and a differential pressure regulator to maintain stable drift-free chlorine gas feed, despite wide variations in chlorine gas pressure, water supply pressure, or pressure at the point of application.

Corrosion-Resistant Vinyl Coating

302

Amercoat Corp., South Gate, Calif., has developed a new high build vinyl coating, Amercoat No. 99, for application with either conventional or airless spray equipment. The new coating is not a mastic, yet it overcomes the application disadvantages of most vinyls, which require multiple coats to achieve minimum protective thickness. It retains the superior chemical weathering and physical properties of Amercoat No. 33, which has been widely used for corrosion control since 1943.

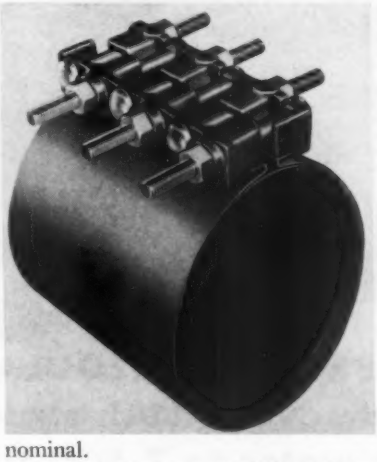
When applied with airless spray equipment, only one cross sprayed coat of No. 99 is required to obtain a dry film thickness of more than 5 mils. Using conventional spray equipment, only two coats are required to produce a dry film thickness of 5 mils. Handling characteristics are excellent; the coating barely sags even with a wet film thickness of 25 mils.

This coating is recommended for use on tank exteriors and all types of structural steel. It may be applied over organic primers and may be teamed with one coat of an inorganic zinc silicate coating such as Dimecote. No. 99 dries to a hard and tough matte finish which adheres firmly and resists abrasion. Non-flammable, odorless and non-toxic, it will not harbor bacteria or fungi.

Full Circle Clamp Coupling for Pipes

303

Smith-Blair, Inc., South San Francisco, Calif., is offering a full-circle, clamp coupling with "all-the-bolts-on-top." A special lug design and alternating bolt arrangement enables it to give high mechanical strength, greater sealing power, and lower initial cost. The new clamp, is a heavy duty design that insures a permanent repair, offers ease of installation, and fits all of the common sizes of cast iron, asbestos-cement, and steel pipe through 8 in. nominal.

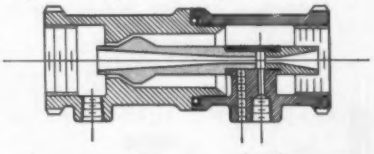


Design advantages include: bolt installation and tightening from the most advantageous working position; nuts grouped for fast rotational tightening; no separate parts to shift and match up; no extra lugs to add weight and complicate positioning and tightening; greater sealing power.

Continuous Flow Air Charger

304

Nielsen Mfg. Co., Oakland, Calif., is offering a new approach to the problem of introducing desirable volumes of air or other gases to pressure systems. Operating through the vacuum generated by a patented venturi action, the Air Charger provides a continuous metering of air or other gases into any pipeline carrying a flow of liquid under pressure. Testing in more than 3,000 installations indicates that the unit can handle the requirements of water pressure systems with storage capacity of over 2,000 gallons.

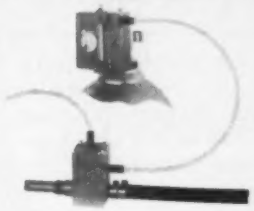


THE *ADVANCE* GAS CHLORINATOR
Made By
CAPITAL CONTROLS COMPANY, INC.

is a simple, compact, low-cost vacuum-operated, solution feed, Gas Chlorinator.

Only tested, proven corrosion resistant materials are used in its design and manufacture.

Three ranges up to 50 lbs. per 24 hours.



COMPACT Connects directly to the chlorine cylinder valve by means of a positive cylinder yoke. It weighs only 3 lbs., measures only 5" x 5" x 6", and takes up no more space than the cylinder itself.

SENSIBLE No special mounting. No drain line. Ejector may be located anywhere—even at the diffu er.

SAFE A positive safety shut-off automatically shuts off the gas supply in the event of an ejector water supply shut-off. A built-in supply indicator gives positive indication when the cylinder is empty.

ECONOMICAL Low cost, simple installation and easy operation saves dollars.

Patent Pending

NOW AVAILABLE!
up to 100 lbs/24 hours
Wall Mounted Controls

CAPITAL CONTROLS COMPANY, INC.
WEST POINT, PENNA.

Four Compact Receivers Added to Telemetering Line

305

B-I-F Industries, Providence, R.I., has announced the addition of four new compact receivers to its line of telemetering instruments: a single function indicator; a dual function indicator; an indicator/totalizer; and a panel mounted totalizer.

These units are designed so they will never need lubrication. They have large, clear graduations and numerals for easy, "at a glance" reading through clear plastic doors, and all are designed for mounting in panels up to ⅞ in. thick with a cut-out 6⅛ in. square. Indicator scales read directly in desired units with use of decimal multipliers; calibration accuracy is ±0.5% of scale span.

Motors Re-Designed to Give More HP with Smaller Unit

306

Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces that it has redesigned its vertical, hollow shaft motor line to provide more horsepower in a smaller package, as well as longer life and reduced maintenance. Most recently re-designed motors in the line (HSHG) are of open drip-proof, high-thrust construction in frame sizes 364UP to 445UP, inclusive.

Functional styling has benefitted motor appearance. A lightweight aluminum top cover can be easily removed for rapid adjustment of pump clearances. A shaft locking bar prevents movements of the motor's rotating parts while the impeller is being adjusted.

Upper and lower bearings are oil lubricated, simplifying lubrication procedures. Self-release couplings are standard equipment, but where motor backspin is undesirable, a pin type non-reversing ratchet is available. Double end ventilation results in a cooler running motor and longer insulation life.

"Job Planned" Utility Truck Body

307

Reading Body Works, Inc., Reading, Pa., is manufacturing a "job planned" utility truck body designed to carry in convenient file-box arrangement all the varied and unusual equipment used in cleaning and repairing sewage systems. The new body serves both as a means of transporting equipment to the job and as a mobile workshop for a sewer maintenance crew.

Designed with weather-tight outside compartments of varying size and roomy interior space for larger equipment, the body carries snakes, rods, auger, and related tools, and

CONTINUED IN PAGE 93A

Equipment News

CONTINUED FROM PAGE 93A

a 3 in. diaphragm type pump and has a "place for everything in its place." All compartments have removable shelves and adjustable shelf dividers for flexibility of arrangement.

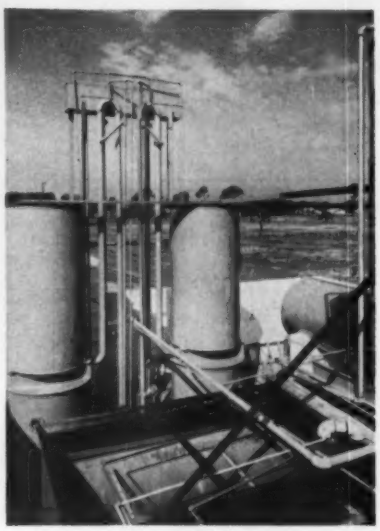
Valve-less Filter Sets Own Backwash Cycle

308

Permutit Co., Div. of Pfaudler Permutit, Inc., New York, N. Y., has introduced a new gravity water filter for municipal and industrial use. The unit is designed to provide a low initial cost and fully-automatic operation requiring less than a watt of power.

To achieve this, the company built its new design around a very old device: the siphon. Combined with a filter bed in a compartmented tank, this siphon performs the backwash operation automatically, and there are no pumps, valves, gauges, or manual or electric controls anywhere in the unit. Actuation of the backwash cycle is accomplished at exactly the optimum moment without any outside aid, the filter cannot over or under-wash, and backwash or rinse water cannot be accidentally run to service. The unit operates on a loss-of-head and can be used wherever gravity feed is feasible.

The new filter consists of a vertical cylindrical steel tank divided into three sections: backwash storage chamber (at top), filter bed compartment, and collector chamber under a false bottom. The backwash storage space is designed to hold the optimum amount of backwash water in relation to the surface area of the filter bed below it. It always fills to the same height and consequently gives an absolutely uniform amount of backwash on every cycle.

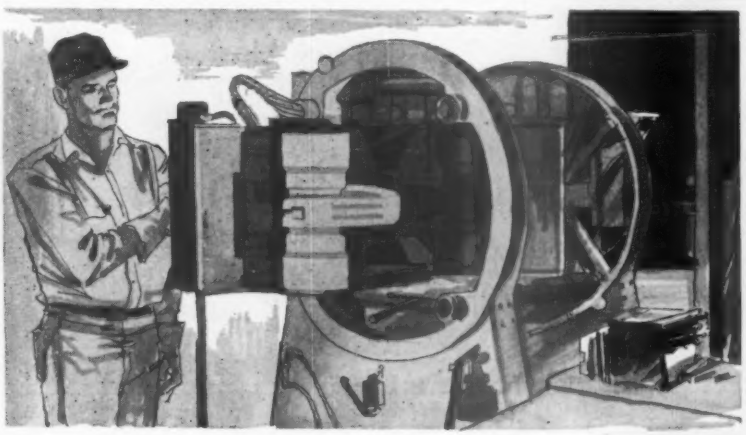


The filter bed contains standard fine filter sand supported on a collection system of disc-type plastic strainers. This system provides uniform collection of filtered water and uniform distribution of backwash water without the use of gravel. The unit can employ other types of filtering material, such as anthracite, or Neutralite, by simply modifying the rate of wash.

Electric Chemical Feeder

309

Bruner Corp., Div. of Hagan Chemicals and Controls, Inc., Milwaukee, Wis., is offering a new electric feeder, designed to introduce small amounts of chemical solution



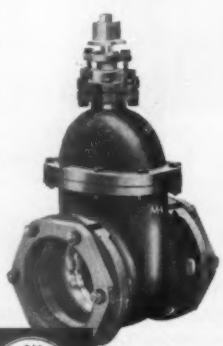
after 34 YEARS

M & H is proud to be recognized as a true symbol of America's famous industrial revolution which has been in progress for some 50 years. The Company's growth is a typical success story of American ingenuity, engineering talent, manufacturing skills, labor-management team work, and mechanization.

With 40 employees and second-hand equipment, M & H started business in 1926 at the height of American industrial development. Later the product was redesigned and modernized, and the plant completely mechanized. Since that time modernization has been almost continuous. Recent years have seen installation of automatic core-sand handling, automatic core-making machines, automatic foundry equipment, new and enlarged machine shop, new two-story office building, and many other improvements.

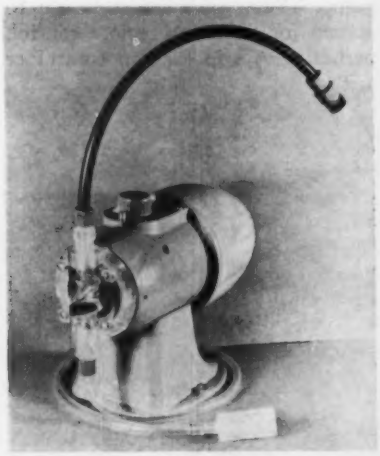
M & H valves, hydrants and associated products today are in use throughout the United States, Canada, and in many foreign countries. Water works men, engineers and industrial operators recognize the enviable reputation of M & H products for being made from highest quality material, rugged in design, dependable and efficient service.

(No. 10 of a Series)



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

into a water system. It may be used in commercial water systems, cooling towers and swimming pools. Specific applications include chlorinating or making water safe to drink,



correcting red water problems, preventing costly scale formation, neutralizing acid water, and controlling hydrogen sulfide odor problems.

The unit's feed rate is adjustable from 2.4 to 20 gpd by means of a fingertip control knob. Positive treatment is assured at any pressure from suction to 100 psi. No external antisiphon valve is required because this feature is built into the pump head. All exposed parts are constructed of high impact plastic for long, corrosion-free life. A compact, heavy duty, 115 v motor powers the feeder. Lubrication is required only every six months and the pump will operate outdoors in rain or snow.

Sewer Flow Measurement

310

San Val Equipment Co., Arcadia, Calif., has, in order to facilitate the use of the Palmer-Bowlus meter for accurate measurement of flow in sewers, manufactured flumes available in various sizes from 8 through 24 in. These units are ready for direct installation into the sewer at an access manhole.

The meters are made of cast iron and so patterned to be installed in the sewer just above the manhole simply by "buttering" with a small amount of mortar. The Palmer-Bowlus meter gives accuracies within three per cent and creates only a slight restriction in the sewer cross-section not interfering with normal sewer functioning. Meters are fur-

CONTINUED ON PAGE 96A

At San Juan, Puerto Rico...

DARLING VALVES GET THE CALL

in new high capacity sewage treatment plant

Shown above is the main pump room at the new Puerto Nuevo sewage treatment plant in San Juan, Puerto Rico... designed to serve nearly 600,000 persons by 1975.

Here, Darling Valves are on the job... ranging in size from 3" to 48". Darling's exclusive *fully revolving double disc parallel seat* feature and "no pocket" discs provide positive sealing and assure ease of operation.

As in cities throughout the U.S., Darling Valves "get the call" because of their reputation for outstanding quality and long, trouble-free service life. Tell us about *your* requirements.

DARLING VALVES

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by
The Canada Valve & Hydrant Co., Ltd., Brantford, Ontario

Equipment News

CONTINUED FROM PAGE 95A

nished together with rating curve and instructions for installations and use.

Hydraulic Valve Actuators

311

Oil-Dyne, Inc., Chicago, Ill., announces production of an hydraulic valve actuator on which the motor and pump run only for the few seconds required to open or close the valve, and which provides an automatic locking feature that holds gate or plug in any desired position almost indefinitely.

Suitable for use on virtually any type or size of valve, the complete unit, including motor, pump and coupling, integral reservoir, pressure switch, and hand pump, gauges and any required safety devices, fits well within overall valve dimensions on most applications.

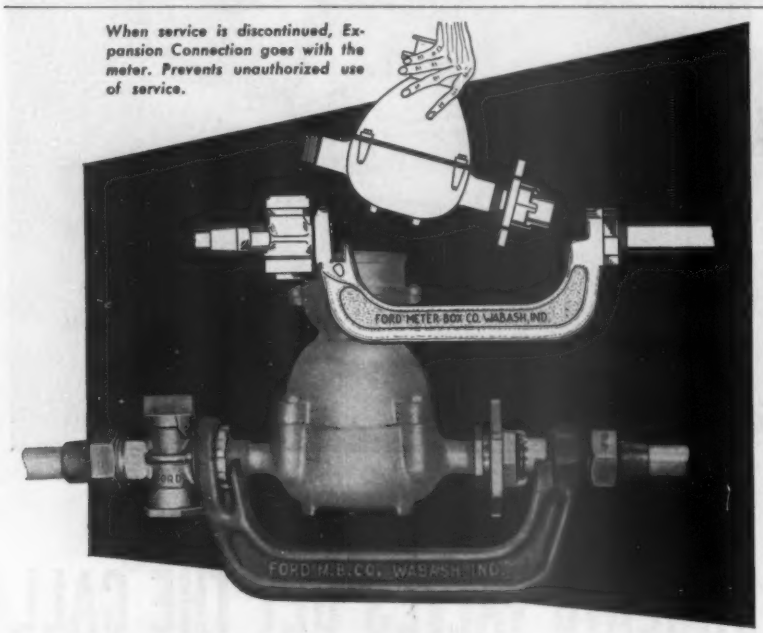
The automatic locking feature is controlled by an internally-mounted directional control valve, an integral part of the company's reversible pump. These valve actuators can be set up for direct or remote control, permitting single location control of

several valves located at different points. Actuators can be equipped with hand pump for use in event of power failure, or on applications where power supply is not available or may not be required due to infrequent valve operation.

Torque Type Valve Operating Unit

312

Hupp Aviation Div., Hupp Corp., Chicago, Ill., has made available a controlled torque type Electrodyne Valve Operating Unit which secures a tight closure by controlled torque action directly on the valve stem. Designed for the electric operation of gate valves, globe valves, sluice gates, butterfly valves and similar applications, the unit permits torque seating or back seating for stem travel in both directions. Accurate positioning is secured by a limit switch,


When service is discontinued, Expansion Connection goes with the meter. Prevents unauthorized use of service.
FORD METER BOX CO. WABASH, IND.
FORD M.B. CO. WABASH, IND.

THE FORD TWIST

that makes In-Line meters easy to change

Whenever meters are set in-line with service piping, especially in outside settings, they are notoriously difficult to get in or out. The Ford *twist* is a simple handwheel operated Expansion Connection on every Ford Straight Line Yoke. To begin with, the Ford Yoke holds both inlet and outlet piping rigidly in perfect alignment and with ample space to slip the meter in or out of position. Then, the Ford handwheel operated Expansion Connection fills the gap and automatically pressure seals both meter ends against rubber gaskets.

Millions of Ford Yokes already make meter servicing a pleasure. Are they doing it for your meter department?

Write for complete information on models available for every condition.

FORD

for *better* water services

THE FORD METER BOX COMPANY, INC., Wabash, Indiana

and a tight closure is made without galling or jamming.

The entire unit is top mounted and all gearing is self-contained. It incorporates a hand wheel operation with gear reduction to reduce hand wheel effort and permit manual operation of the largest valves.

Bellows Actuated Transmitter

313

B-I-F Industries, Providence, R.I., has announced the addition of a new Chronoflo Bellows Flow Transmitter to its line of telemetering instruments. This transmitter is for pressure operated, explosion-proof remote flow metering service in sew-

age and waste treatment plants or in pipeline distribution of gas or other hazardous materials.

The differential pressure unit contains no mercury and is capable of withstanding working pressures up to 1000 psig with standard construction. Units for higher pressures are available. Rupture-proof bellows can withstand overages equal to the safe working pressures of the housing without deforming the bellows, causing loss of zero adjustment or change in calibration.

Above Ground Pipeline Repair Method

314

Centriline Corp., New York, N. Y., has developed a method of sealing pipelines from the interior, which is remotely controlled from above ground and which eliminates costly, time-consuming excavations.

A closed-circuit television is utilized to inspect pipeline interiors and to locate leaking joints or damaged pipe sections and to determine the extent of repairs required. Special grouting equipment and a television camera are then inserted and passed through the pipe. The sealing machine is a spool-shaped plug with expanding seals.

Using the camera for checking and determining the exact location of the leak, the seals are expanded to force a chemical grout through the joint to the surrounding water bearing strata.

Air-Operated Back Pressure Operators

315

OPW-Jordan Corp., Cincinnati, Ohio, announces the availability of 4 and 6 in. sliding gate, air-operated, back pressure regulators that have capacities up to 50,000 lbs of steam per hour or 25,000 gpm of water. Sliding gate seats used in both the pilot and main valve give accurate

CONTINUED ON PAGE 98A

NICHOLS HERRESHOFF FURNACES
MAINTENANCE COST FOR 20 YEARS:
50 Cents
Per
Dry Ton

Detailed cost studies at typical Nichols Herreshoff installations, some operating for OVER TWENTY YEARS, show maintenance costs — labor and materials — to be less than 50c per ton of dry solids burned.

This economy, the PROVED rugged construction, and simplicity of operation of the Nichols Herreshoff Furnaces are unequaled in the sludge burning field.

Write today for 24-page Brochure "Nichols Herreshoff Sludge Furnaces".

Economical — Simple — Clean — Safe

NICHOLS Engineering & Research Corp.
80 Pine Street, New York 5, New York
3513 N. Harvey Street, Indianapolis 18, Ind. • 1336 North Carolan Ave., Burlingame, Calif.

Equipment News

CONTINUED FROM PAGE 97A

regulation, tight shut-off and minimum maintenance. These gate seats are self-cleaning and self-lapping, reduce maintenance problems and provide close control.

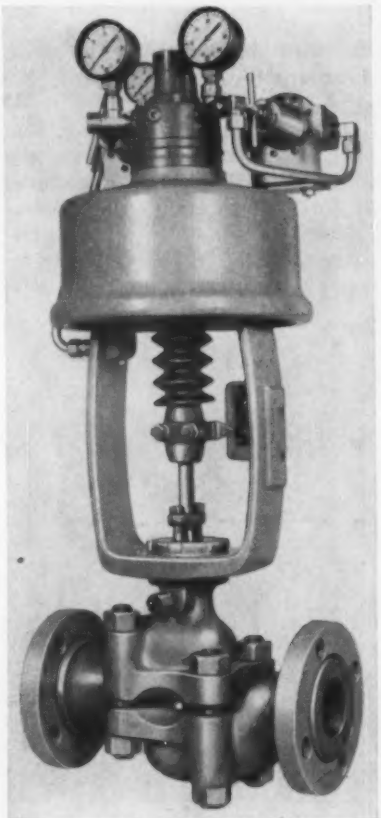
The system is suitable for pressures to 250 psi WSP and temperatures to 500° F. The main valve is cast iron with 125 lb ASA flanges, or ductile iron with 150 lb or 300 lb ASA flanges. The pilot is a standard screwed end control valve with special sliding gate seats.

Split-Body Valves

316

Minneapolis-Honeywell Regulator Co., Fort Washington, Pa., has introduced a series of split-body valves interchangeable on a "mix and match" basis with other valves and actuators it now produces. The addition of the new valve as well as a cylinder actuator to its product line makes possible an intermix of diaphragm and cylinder actuators with split bodies and globe bodies to match specific applications at the lowest possible combination price.

The split-body valve, available in straight-through, angle and corner types with fixed or separable flange construction, is designed for free passage of even highly viscous



fluids. A clamped-in seat ring, metal or Teflon guiding, non-lubricated V-ring packing, and contoured equal-percentage, linear or quick-opening plugs are other features of the split-body valve.

control

for algae and aquatic weeds

In small amounts, Triangle Brand Copper Sulfate controls algae growth and kills some of the more troublesome aquatic weeds. They disintegrate where they are, which prevents downstream infestation or clogged waterways.

In sewage pipes, Triangle Brand Copper Sulfate can be used in such low concentrations to control root and fungus growth that surface trees remain unaffected.

Two informational booklets, "The Use of Copper Sulfate in the Control of Microscopic Organisms," and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains," available on request.

Phelps Dodge Refining Corp.
300 PARK AVENUE, NEW YORK 22, N. Y.

Oh, we could build you a sewage disposal plant at half cost—if you want half a plant.

News of Suppliers

Chain Belt Names Weil to Head Eastern Sales

The appointment of Harold M. Weil as its Eastern regional sales manager has been announced by Chain Belt Company, Milwaukee. Weil has been serving as manager of the firm's Philadelphia office since 1956.

As regional manager, he will remain in, and be responsible for, the Philadelphia office as well as the company's Baltimore, East Orange, New York, Springfield and Boston offices. Weil joined Chain Belt in 1923. In 1936 he was transferred to San Francisco as a sales engineer and, in 1945, joined the company's New York office where he served as a sales engineer until his move to Philadelphia.

Weil succeeds Joseph B. Roberts who retires January 1, 1961 after 39 years with the company. Roberts joined Chain Belt's New York office in 1932 and was appointed district sales manager there in 1945. He was named Eastern reigonal manager in 1956 with headquarters in the firm's East Orange, N. J. office.

Succeeding Weil is William W. Byrne who moves to Philadelphia from Baltimore. He has been with Chain Belt since 1952 when he joined the New York office as a sales engineer. In 1956 he transferred to the firm's Baltimore office as a district sales manager.

Pipe Linings Names Representative

Pipe Linings, Inc., a subsidiary of the American Pipe and Constructio Co., Wilmington, Calif., has announced that it has appointed the National Water Main Cleaning Co., New York, N. Y., as its exclusive sales representative for the Eastern United States and Canada.

The California firm is celebrating its 20th year.

General American Transportation Corp. Acquires Infilco

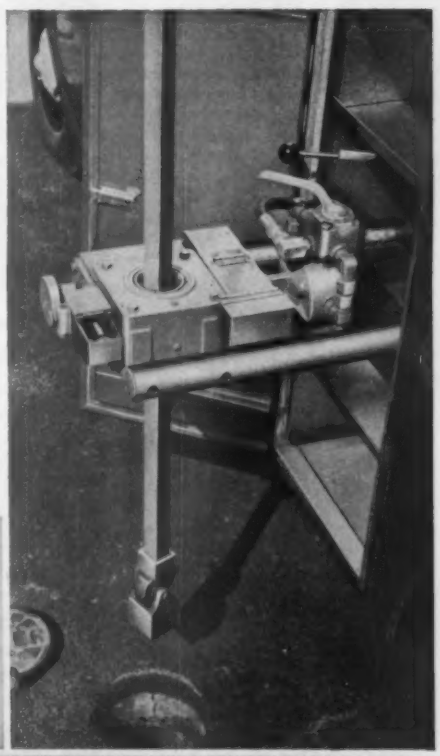
Mr. T. M. Thompson, President of General American Transportation Corporation of Chicago and Mr. J. S. Gustafson, President of Infilco Inc. of Tucson, announced January 24th that the Chicago corporation has acquired the outstanding stock of Infilco Inc.

Present plans are that Infilco, for sixty-three years a major supplier in the field of water and waste equipment design and manufacture, will continue to operate under its present management as part of the Fuller group of General American Transportation Corporation.

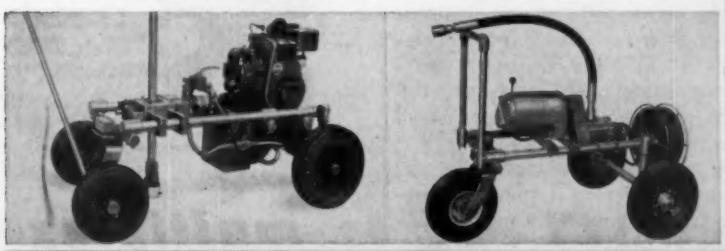
Mr. R. G. Biesel, Vice-President

CONTINUED ON PAGE 100A

HYDRAULIC TRUCK MOUNTED VALVE OPERATORS PROVIDE ONE MAN CONTROL OF VALVES FROM 10" TO 60" SHIPPED FULLY ASSEMBLED, FOR MOUNTING IN ANY MAKE OF TRUCK BY YOUR OWN MECHANICS, WITHIN A FEW HOURS. HAS SAFETY DEVICE FOR DAMAGE PROTECTION ALSO POSITION INDICATOR.



PORTABLE 3-10 HP. ELECTRIC DRIVE



Makes EVERY VALVE Power Operated. Payne Dean & Co. Clinton, Conn.

RESEARCH CUTS SEWER LINE COSTS!

The Clay Pipe Industry's research has pioneered dramatic new developments, making production and installation of lifetime Vitrified Clay Pipe more efficient and effective.

For example, Clay Pipe Industry research discovered the revolutionary resilient compression joints which are now offering important savings in installation time and cost to users of lifetime Vitrified Clay Pipe sanitary sewers.

Other important tests are now going on at the Crystal Lake facility, by contract at colleges and universities all over the country, and at the modern laboratories maintained by individual Clay Pipe manufacturers.

One experiment that promises to have far-reaching effects: detailed, year-long observations of root penetration of 16 separate sewer pipe joints. Others include shear load studies of both pipe material and joints, development of new, less expensive jointing materials and techniques, exhaustive analyses of competitive products, flow-coefficient studies, and various tests aimed at improving the clay pipe itself.

Results of the most significant of these tests will be announced as they become available.

Under the direction of A. J. Reed, NCPMI Vice President and Director of Research, new breakthroughs in manufacturing and uses of Clay Pipe are being made, offering greater, more confident service to those who specify and use lifetime Vitrified Clay Pipe.

NATIONAL CLAY PIPE MANUFACTURERS, INC.
914 20th Street, N. W.
Washington, D. C.

Please send me full details on the new factory-made compression joints on Clay Pipe.

(name)

(company)

(street address)

(city and state) B-313 WS

COMPRESSION SEALED, VITRIFIED CLAY PIPE — IMPERVIOUS — THE STANDARD in SANITARY SEWERS

NATIONAL CLAY PIPE MANUFACTURERS, INC.
Washington, D. C.

News of Suppliers

CONTINUED FROM PAGE 99A

of General American and Mr. Channing Davis, President of the Fuller Co., stated that the operations of Infilco will complement the operations of the process equipment, plate and welding, and field erection divisions of the corporation.

A. L. Gray Retires from Pfaudler Co.

Alton L. Gray, Director of Sales, has retired from The Pfaudler Co., a division of Pfaudler Permutit Inc. effective last December 31. He will join Smith and Norrington, Engineering and Construction Co., Boston, Mass., as General Sales Manager.

Retiring after 38 years with Pfaudler, Gray joined the company in 1922 as a sales engineer. Before that, he was Chief Draftsman for Ansco Camera Co. and I.B.M. and Design Engineer for the Todd Co. where he was a holder of several patents.

In 1949 Gray was named District Sales Manager, in 1956 Assistant General Sales Manager, in 1957 General Sales Manager; and in 1958 Director of Sales.

Komline-Sanderson Completes Latest Expansion

Komline-Sanderson Engr. Corp., Peapack, N. J., announces the completion of its latest expansion program.

At Peapack, N. J., a large new two story, 180 x 50 ft administrative and engineering center has been completed, while 75 KW automatic welding, automatic punch press and roll forming equipment have been added to manufacturing facilities.

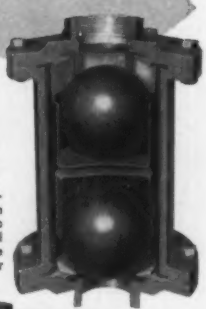
At Brampton, Ontario, Canada, Komline-Sanderson Limited, a subsidiary, has completed a modern 12,000 square foot plant and office building fully equipped and staffed to manufacture most of the Komline-Sanderson line of equipment.

Crispin UNIVERSAL AIR VALVES

. . . positive, full-time air control when line is filled, in operation or emptied.

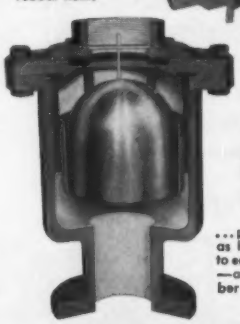
Crispin
AIR CONTROL Valves

- peak efficiency
- maximum dependability
- minimum maintenance
- simplified construction
- easy accessibility



Crispin NEGATIVE PRESSURE AIR VALVES

. . . release air semi-automatically from pipeline siphons to end danger of throttled pipeline — available with either metal or rubber float.



Crispin AIR AND VACUUM VALVES

. . . permit air to escape as line fills, allow air to enter as line empties —available with rubber or metal float.

Write, wire or phone for complete information and your free copy of the Crispin Air Control Valve catalog.

AIR CONTROL VALVES FOR OVER 50 YEARS

multiplex
MANUFACTURING COMPANY
BERWICK, PENNSYLVANIA
Dept. B

New Literature

AVAILABLE FREE

Tyton Joint Bulletin

317

United States Pipe and Foundry Co., Birmingham, Ala., is offering a bulletin that describes the features of its Tyton pipe joint.

Using drawings and a detailed text, the bulletin explains the assembly of this type joint, fork-tool methods of assembly and disassembly, and the assembly of field cut pipe.

Pertinent facts, advantages and specification wording on this joint are presented, and brief section describing the fittings for use with Tyton is also included.

Two-Way Radio Network

318

Motorola, Inc., Chicago, Ill., is offering two bulletins that explain the features and operation of its Motorac two-way radio and Quik-Call selective signaling equipment.

The Motorac is a transistorized unit that provides 5 watts of audio output, provides a reduction in power needed to run the unit, eliminates the use of vibrators and is built to a compact design. The Quik-Call system enables dispatches to select any of its mobile units for individual transmissions.

Both bulletins illustrate the use of this equipment and show pictures of the units installed and for various applications.

Sewer Tapping Equipment

319

Shewer Tap, Inc., Kansas City, Mo., is offering literature that explains the company's method of providing taps for house service sewers to be connected to sewer mains. The bulletin shows the prevailing method which utilizes wye branches or tapping saddles and compares it with the company's method which uses its special drilling and tapping equipment.

Any type of service pipe may be connected to this tap which is available in 4 and 6 in. sizes, and which fits into any size pipe. The principle advantage of this method is that it eliminates the cost involved when contractors, attempting to connect a house sewer, must spend time and effort locating a wye or tapping saddle.

Fire Pumps

320

Layne and Bowler, Inc., Memphis, Tenn., announces the publication of a 6-page illustrated bulletin that shows cross-section drawings, typical installations, size and capacity charts, and detailed advantages of the company's Vertical Fire Pump.

Both oil and water lubricated types are shown complete with accessories to meet the Factory Mutual and Underwriters' Laboratories requirements.

Measuring Instruments

321

Photovolt Corp., New York, N. Y., has issued a 6-page illustrated condensed catalog of the company's line

CONTINUED ON PAGE 102A

PACIFIC
A TYPE FOR EVERY SERVICE
RUGGED — DEPENDABLE
NON-CLOG
SEWAGE PUMPS
DRY PIT - WET PIT
SUBMERSIBLE
HORIZONTAL
CHOICE OF IMPELLERS
NON-CLOG DRY PIT pump with double suction elbow and stand. Send for Bulletin 1850.5.
NON-CLOG WET PIT with cover. Single unit. Duplex models with alternating controls available. Send for Bulletin 1850.2.
PACIFIC NON-CLOG PUMP with motor, motor support bracket, suction elbow and stand. Send for Bulletin 1850.5.
HORIZONTAL NON-CLOG MODEL with flexible coupling. Send for Bulletin 1850.5.
Outstanding performance and long trouble-free service from every type.
Pacific Non-Clog Sewage Pumps combine all desirable design features that assure efficient, economical and dependable operation and service.
Order now. ALL TYPES AVAILABLE FOR IMMEDIATE SHIPMENT.
SUBMERSIBLE NON-CLOG
A complete unit ready to install includes pump, motor, automatic controls and cable to control panel. Send for Bulletin 1850.5.
PACIFIC PUMPING CO.
Established 1907
Manufacturers and Distributors of Pumps for Every Service
MAIN OFFICE AND FACTORY: 9301 San Leandro St., Oakland 3, Calif.
OAKLAND, Calif. • Portland, Ore. • Seattle, Wash. . Los Angeles, Calif. . Dallas, Texas

New Literature

CONTINUED FROM PAGE 101A

of photoelectric and electronic measuring instruments. The equipment is classified in six sections for easy reference.

The instruments described include units for pH, oxidation-reduction and titration measurements; colorimetry, fluorimetry, polarmetry and turbidimetry; photemtry and photomicrography; clinical analysis; paper electrophoresis and chromatography; and general laboratory purposes.

Screen Strainers

322

Strataflo Products, Inc., Fort Wayne, Ind., has published a 4-page bulletin, S-56, that describes its line of taper and basket type pump strainers and special large capacity strainers.

Included in the publication are lists of specifications and prices for each type pump strainer and specifications of the special units. Pictures of each category of strainer are provided.

Two-Stage, Bio-Filtration Sewage Treatment Plants

323

Link-Belt Co., Colmar, Pa., has available recently published literature that presents the major features of its Bio-Pac, two-stage, Bio-Filtration sewage treatment system which provides complete service for populations ranging from 50 to 500 people.

The literature contains the system's specifications and provides cutaway drawings of the system in operation to illustrate how the unit works and what its main components consist of. Unit selection and dimension tables are also included.

Leak Detector and Valve Locator

324

Goldak Co., Glendale, Calif., has released a 2-page bulletin that tells of the features and specifications of the company's "Titan" leak detector and "Sweeper" valve detector. Both units have fully transistorized circuits and are completely portable.

The units' operation and construction features are explained, and both units are pictured being used in the field.

Digester Circulator-Mixer

325

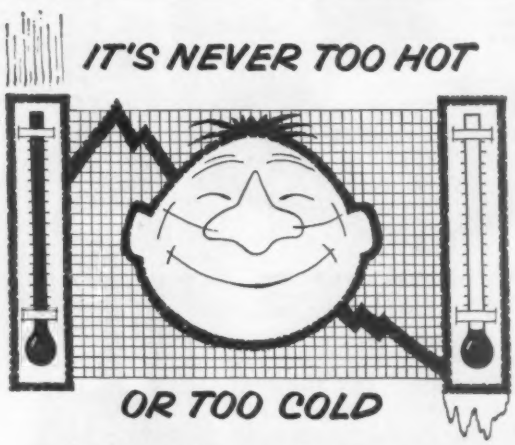
Walker Process Equipment, Inc., Aurora, Ill., has published an 8-page bulletin that gives a description of its digester circulator-mixer, gaslifter unit.

On-the-job photographs of these units illustrate both construction and operational features; a 2-page cutaway spread illustrates how the unit operates and achieves its design purpose. Also included are brief descriptions of the unit's main components and a list of main specifications.

Odor Control Problems Solved

326

Airkem, New York, N. Y., has released a 4-page brochure, complete with pictures, which describes how typical waste odor problems may be successfully controlled, whether over a large or a small area. Although each sewage problem must be treated individually, the company's odor counteractant chemicals quickly and thoroughly kill odors emanating from



ENTERPRISE
engines have the really efficient cooling system

ENTERPRISE Diesels
THE DEPENDABLE

Enterprise Engine & Machinery Co.
Subsidiary of General Metals Corporation, 18th & Florida Streets, San Francisco 10, Calif. • National and worldwide sales and service.

Don't throw maintenance money away!
NoDrip TAPE PERMANENTLY PROTECTS AGAINST CONDENSATION AND RUST AT LOWEST COST.

Any maintenance man can check this. Handy 16' rolls of ⅛" thick NODRIP TAPE fits any size pipe or fitting. Never absorbs moisture. *Permanently* insulates against damaging pipe sweating — even around unions, tees, angles and valves.

NoDrip PLASTIC COATING
Another fine Mortell product. Use on metals, concrete, brick, tile, plaster surfaces. Apply by brush, trowel or spray to large pipes, tanks, walls, ceilings, air ducts, to eliminate sweating. 1 or 5 gal. cans or 55 gal. drums.

At all leading hardware, mill supply and plumbing jobbers. For full information and technical handbook, write

Mortell COMPANY
599 Burch Street, Kankakee, Ill.

pumping stations, grit screen areas, digesters, trickling filters, sludge beds and lagoons. The chemical installations have no effect on natural bacterial processes and are effective on soluble and insoluble gases.

The complete systems are easy to install, require no interruption of plant operation and require little attention once the correct dispersion rate is selected.

Chemicals Digest

327

Hooker Chemical Corp., Niagara Falls, N. Y., has published a revised 16-page digest titled "Hooker Chemicals," in which 94 organic and inorganic chemicals produced by this company for industry and agriculture are reviewed. The new bulletin gives useful factual information covering 88 commercially produced chemicals and 6 development products. Included are more than 20 new or recently developed chemicals.

A brief description, physical data, chemical formulas, uses and types and weights of shipping containers are presented for all 94 chemicals listed.

Ball Valves for Water

328

Willamette Iron and Steel Co., Portland, Ore., is offering its recently published bulletin describing the List 26 ball valve designed primarily for water and sewage applications.

Cutaway drawings show the construction and main operational features of the unit, and on-the-job photographs show how these valves have been installed in pumping stations across the country. The bulletin also includes a list of design characteristics and job applications.

Rapid Sand Filter Control

329

Bailey Meter Co., Cleveland, Ohio, announces the release of a 4-page, illustrated brochure that describes the operation of sand filter controls in modern automatic plants.

To explain the details of the company's pneumatic control systems, a thorough textual and graphic description of a complete pneumatic filter control system with auxiliary instrumentation, which is stable and free from cycling, is presented.

Also included in the brochure is a list of primary elements for flow applications.

CONTINUED ON PAGE 104A

PREFABRICATED PNEUMATIC SEWAGE EJECTOR STATIONS

Komline-Sanderson's prefabricated ejector stations offer options and construction features not usually available in stations of this type . . . ⅜" thick station walls, protected by epoxy base paint . . . cast iron or welded steel receiving pots . . . valve and fitting accessibility . . . electronic or mechanical control. Options such as operation counters to meter flow . . . high water alarm . . . connections for auxiliary portable air compressors or generators.

K-S stations are designed and built for dependability. Should service be necessary, the K-S service organization is always available.

KOMLINE-SANDERSON ENGINEERING CORPORATION
PEAPACK, NEW JERSEY
BRAMPTON, ONTARIO, CANADA

FINEST IN PERFORMANCE
BACKED BY THE FINEST
IN SERVICE

Write For Bulletin
No. KSM-3

YOUR CHOICE OF 3 TELEMETERING SYSTEMS

Remote Supervisory Controls designed and manufactured by Healy-Ruff Company are easy to apply—simple to use. Control only, or recording and indicating as well can be supplied. All systems incorporate these desirable features:

- Receiver can be any distance from transmitter
- Only one pair of wires is required
- 48 volt D.C. signal is used for lowest telephone line charges
- Heavy-duty mercury switches permit direct operation of motor starters

The RTM provides multi-circuit control, up to 8 circuits over one pair of wires, with single receiver. Transmitter can be pressure or float-operated. A D.C. signal in direct proportion to the pressure or level being sensed is transmitted, using proven time-impulse principle. Receiver can be furnished with recorder and indicator.

The Bi-trol controls two pumps over one pair of wires. First signal operates one pump—second signal operates other pump. An alternator can be supplied to equalize pump wear.

The Uni-trol controls a single pump. Type TAE is available with a return signal, to indicate the pump has started.

Write for Bulletins RTM and SC

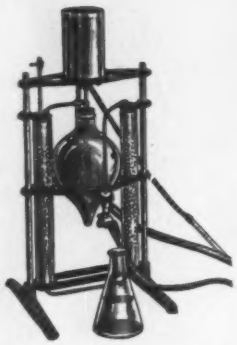
HEALY-RUFF COMPANY
783 Hampden Avenue • St. Paul 14, Minn.

First in dependable controls for waterworks and sewage—since 1929

Remote supervisory controls • Complete system controls • Elevated tank controls • Sump controls • Hydropneumatic tank controls • Float controls • Alternators • Alarm silencers • Protective devices

ENSLOW

STABILITY INDICATOR



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

New Literature

CONTINUED FROM PAGE 103A

Pneumatic Sewage Ejector Stations

330

Komline-Sanderson Engr. Corp., Peapack, N. J., has just published a 4-page brochure describing the company's prefabricated pneumatic sewage ejector stations. The publication outlines the units' construction features and includes a compressor motor horsepower chart.

Also included in the bulletin are plan and elevation drawings of the stations and a recommended form of specifications.

Sludge Density Control

331

Ohmart Corp., Cincinnati, Ohio, tells how the density of sludge in sewage treatment plants is automatically controlled by the company's density control systems is described in newly isued bulletin. The system employs a gamma radiation source and the patented Ohmart cell which converts gamma radiation directly into electrical energy for density measurement and control.

Gas Chromatographs

332

Loe Engineering Co., Altadena, Calif., has made available an application data sheet covering the use of gas chromatographs for the analysis of digester gas and other similiar applications. This application sheet describes the use of a Loenco Model 15A for such applications.

Simplified Method for Determining Water Bacteria

333

Millipore Filter Corp., Bedford, Mass., has available a 20-page illustrated "Application Manual for the Microbiological Analysis of Water". The method employs the membrane filter technique recently approved by the American Public Health Assn., as a standard method for the enumeration of coliform bacteria in water supplies.

The Manual includes a color frontpiece showing various organisms from samples on the filters. It pro-

FREE overnight PARKING (while space is available) FOR REGISTERED GUESTS IN DOWNTOWN DETROIT

special FAMILY RATES

No Charge for Children 12 and Under

In the center of all downtown activities. Newly decorated. Ultra modern, comfortable guest rooms. Excellent food at moderate prices in our modern coffee shop and cafeteria.

Radio, Television Room Available.

Air Conditioned rooms in season.

800 ROOMS WITH BATH from $4

Hotel TULLER

FACING GRAND CIRCUS PARK

DETROIT, MICHIGAN

Harry E. Paulsen, Gen. Mgr.

the nameplate of dependability...

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

going to cleveland?

the "downtown" location for businessmen, group meetings, or vacationists is at East 6th & St. Clair Avenue.

• Family rates • 3 fine restaurants • AAA recommended • garage & Parking lot adjacent • closest to the Stadium & public auditorium

from $5.50

William T. Lanham Gen. Mgr.

CH 1-5100

stay at the AUDITORIUM HOTEL

vides detailed, illustrated instructions on the methods of using the filter for water testing both in the laboratory and in the field.

A section is included which describes the procedures for the bacterial examination of water, sewage sludge or bottom materials.

Chemical Services

334

Dow Industrial Service, (Dow Chemical Co.), Cleveland, Ohio, announces the publication of an 8-page booklet that describes its chemical services in areas of equipment, water and waste treatment and processing, laboratory and technical counseling, product sales and services.

Engineering Manual for Plastic Pipe

335

Evanite Plastic Co., Div. of Evans Pipe Co., Carrollton, Ohio, is offering a 35-page bound, loose-leaf engineering manual that presents the details of Evanite plastic pipe and fittings. Technical data includes sections on physical properties and chemical resistance, flow factor and design, abrasion resistance, supporting strength and crushing tests, determination of trench backfill loads, and lining of existing sewers.

Telemetering Equipment and Systems

336

B-I-F Industries, Providence, R. I., has issued an 8-page bulletin that provides pertinent information about its Chronoflo® telemetering equipment and systems.

This publication explains the basic facts of the transmitting and receiving operation in a time-duration system. It also presents a picture and a description of this equipment and accessories.

Vertical Synchronous Motors

337

Electric Machinery Mfg. Co., Minneapolis, Minn., is offering a product publication that describes its line of vertical synchronous motors ranging in size from 250 hp and up. The motor line is particularly suited for vertical pump drive.

These motors feature durable cage windings for permanent starting characteristics, heavy section, steel plate frame, duty selected bearings (leakproof and dustproof), anchored field coils and "cool-air" ventilation.

They are available in either hollow or solid shaft construction at speeds of 1100 rpm and lower and at all standard voltages.

Automatic Determining of Boron Content

338

Technicon Controls, Inc., Chauncey, N. Y., has released a 2-page data sheet that describes a continuous automatic method for determining the boron content of water down to parts per million.

The complete chemical methodology is detailed. A flow diagram of the analytical system is included, as well as actual chart recordings derived.

Sludge Collectors for Rectangular Settling Tanks

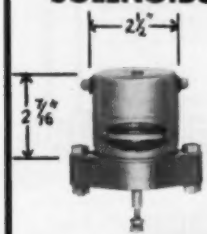
339

Link-Belt Co., Chicago, Ill., has made available a new 28-page book describing the company's complete line of "Straightline" sludge collectors for rectangular settling tanks. New data in this publication provides for the selection of the proper size tank for both the type "H" and type "L" sludge collectors. New mechanical details and arrangement

CONTINUED ON PAGE 106A

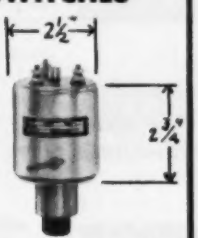
Synchro-Start

HEAVY DUTY D.C. SOLENOIDS



These solenoids are ruggedly constructed, having a life expectancy of over 2,000,000 operations at a rated capacity of 10 lbs. pull. They are available with ½, 1 and 1½ inch stroke.

SPEED SENSITIVE SWITCHES



An extensive line of speed sensitive switches, with various mountings and drives to suit the needs. One or more snap switches contained in a single unit can be furnished to trip at any given speed with an adjustable range for each.

SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE., SKOKIE, ILL.

LOWEST LUBE OIL CONSUMPTION!

Keep operating costs down with
ENTERPRISE
dependable engines

ENTERPRISE Diesels
THE DEPENDABLE

Enterprise Engine & Machinery Co.
Subsidiary of General Metals Corporation, 18th & Florida Streets, San Francisco 10, Calif. • National and worldwide sales and service.

New Literature

CONTINUED FROM PAGE 105A

drawings of various designs for both collectors are illustrated and described.

These collectors are adaptable to Uniflow settling tanks and preaeration settling tanks. Both of these products are also illustrated in the new book. Motorized and hand-operated skimmers, non-rising stem-and-rack and pinion-type sludge withdrawal valves are also shown.

Note: The "Ten States Standards for Sewage Works" specifications for sedimentation tanks are reprinted in their entirety in this book. These standards will prove of particular interest to sanitary equipment engineers and consultants as a quick and indispensable source of reference.

Waterworks Superintendent

Professional engineer to manage municipal water and sewer utility for fast growing midwestern capital and university city of 135,000. In addition to its many cultural advantages, Madison is surrounded by large lakes affording natural recreational opportunities. Depending on experience, beginning salary will be within the range of $10,140 to $12,420 a year. Highest ranking applicants on written examination will be invited to Madison for the oral interviews with travel expenses paid. Apply—Personnel Department, 404 City-County Building, Madison 9, Wis.

MANUFACTURERS REPRESENTATIVES wanted to sell Invex ozone generators for odor control. Exclusive territories still available. Excellent year-round repeat sales. Specified by leading engineers. Attractive commissions. Write Invex Inc., Box 1335 North Miami, Florida.

SEWAGE TREATMENT PLANT OPERATOR

Sewage Treatment Plant operator to be responsible for the operation of a 1.5 MGD secondary type sewage treatment plant with pumping station, primary and secondary sedimentation, trickling filter, contact tank, heated sludge digesters and sludge drying beds, located in Morris County, New Jersey.

Previous experience in this type of plant operation required, must qualify as Grade A operator in New Jersey. Salary open—depending upon qualifications.

Send resume containing personal history, experience and educational record to HANOVER SEWERAGE AUTHORITY, Harold R. Keenan, Administrator, Box 247, Whippany, New Jersey.

NATIONAL TRADE ASSOCIATION has opening for young engineer in Chicago office. C. E. degree with two to five years experience in water works field required. Future activity will include travel for Technical sales promotion in specific area. Salary open. Box 3000, Water & Sewage Works, 185 No. Wabash Ave., Chicago 1, Illinois.

research manager

MS in sanitary or chemical engineering with 7-10 years experience in water and waste treatment field to direct research and development program. Will ultimately supervise laboratory and pilot plant staff of 15 to 20. Will be responsible for coordination of program within own division and with other divisions of the corporation.

Excellent growth opportunity for creative, energetic scientist with progressive company. Send resume with salary requirements to: Box 3001, Water & Sewage Works, 185 N. Wabash Ave., Chicago 1, Ill.

FAST SERVICE *anywhere*

through 23

ENTERPRISE

engine sales and service offices in the U.S.A. and Canada

ENTERPRISE *Diesels*

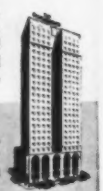
THE DEPENDABLE

Enterprise Engine & Machinery Co.
Subsidiary of General Metals Corporation, 18th & Florida Streets, San Francisco 10, Calif. • National and worldwide sales and service.

Four Fine Facilities in PITTSBURGH

ALLEGHENY MOTOR INN

Opposite Greater Pittsburgh Airport. 60 air-conditioned rooms, tile bath, TV, radio, phone. Superb restaurant and cocktail lounge. Year-round swimming pool. Courtesy car to and from airport. AMherst 4-7790



HOTEL PITTSBURGHER

In the heart of the Golden Triangle. 400 outside rooms, bath, radio, TV, air-conditioning. General Forbes Lounge & Dining Room. ATlantic 1-6970

JACKTOWN MOTOR HOTEL

1 mile west of Irwin Interchange on Route 30. 60 air-conditioned rooms with TV, telephone, combination tile baths. Excellent dining room and facilities for group parties. UNderhill 3-2100

HOTEL PITTSBURGHER MOTEL

Opposite Greater Pittsburgh Airport. 56 air-conditioned rooms, tile bath, radio, TV, private phone. Courtesy car to and from airport. AMherst 4-5152

KNOTT HOTELS

Joseph F. Duddy, Gen. Manager

*Teletype Service. Telephone any Knott-Hotel. All Knott Hotels and offices in U.S. connected by teletype.

Route 30, Lincoln Highway,
Shortest Route to Pittsburgh

Meetings

CONTINUED FROM PAGE 4A

Director, DHEW, PHS, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

Apr. 6-7—Bluefield, West Va. (*West Virginia Hotel*) West Va. Water Pollution Control Assn. Secy., G. O. Fortney, c/o State Dept. of Health, Charleston 5, West Va.

Apr. 6-7—Durham, North Carolina (*Duke University*) Tenth Southern Municipal & Industrail Waste Conference. Jointly sponsored by the University of North Carolina, North Carolina State College and Duke University. Write: Edward H. Bryan, Assoc. Prof., Dept. of Civil Engineering, Duke University, Durham.

Apr. 6-8—Helena, Montana (*Placer Hotel*) Montana Section A.W.W.A. Secy., A. W. Clarkson, Asst. Dir., Div. of Environmental Sanitation, State Board of Health, Helena.

Apr. 10-11—Buffalo, N. Y. (*Statler-Hilton Hotel*) New York Section A.W.W.A. Secy., Kimball Blanchard, New York Branch Sales Office, Neptune Meter Co. 22-22 Jackson Ave., Long Island City 1.

Apr. 12-14—Hutchinson, Kansas (*Baker Hotel*) Kansas Section A.W.W.A. Secy., Harry W. Badley, Neptune Meter Co., 119 W. Cloud, Salina.

Apr. 12-14—Hutchinson, Kansas (*Baker Hotel*) Kansas Sewage & Industrail Wastes Assn. Secy., Howard F. Saiger, 1900 E. Ninth, Wichita, Kans.

Apr. 14—Santa Barbara, Calif. (*Biltmore Hotel*) California Section A.W.W.A. Secy., Frank F. Watters, Hydr. Engr., State Public Utilities Com., State Bldg., Civic Center, San Francisco.

Apr. 17-18—Ann Arbor, Mich. (*Rackham Bldg.*) Fourth Conf. on Great Lakes Research. Sponsored by Great Lakes Research Div. of the Univ. of Michigan's Institute of Science and Technology. Gen. Chairman, Dr. Charles F. Powers, Great Lakes Research Div., 1119 Natural Science Building, Ann Arbor, Mich.

Apr. 19-21—Lincoln Nebraska (*Cornhuskers Hotel*) Nebraska Section A.W.W.A. Secy., Joseph J. Rossbach, Metropolitan Utilities, 18th & Harney Sts., Omaha.

Apr. 20-22—Chandler, Arizona (*San Marcus Hotel*) Arizona Section A.W.W.A. Secy., A. D. Cox, Jr., Secy & Comptroller, Arizona Water Co., Box 5347, Phoenix.

Apr. 20-22—Chandler, Arizona (*San Marcus Hotel*) Arizona Sewage & Water Works Assn. Secy., A. D. Cox, 2612 N. 16th St., Phoenix, Ariz.

Apr. 23-26—Greenville, South Carolina (*Poinsett Hotel*) Southeastern Section A.W.W.A. Secy., N. M. deJarnette, 96 Poplar St., N. W. Atlanta, Ga.

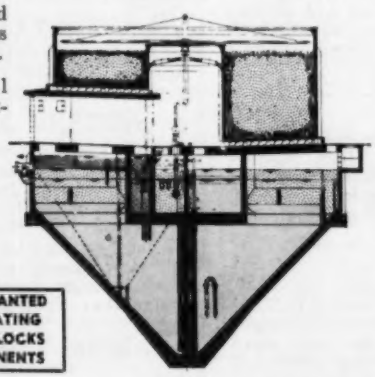
Apr. 26-29—Victoria, B. C. (*Empress Hotel*) Pacific Northwest Section A.W.W.A. Secy., Fred D. Jones, W. 2108 Maxwell Ave., Spokane, Wash.

AMERICAN SCHREIBER COMPACT TREATMENT PLANTS

A fully automatic, complete biological treatment system for from 120 to 5,000 persons. Housed in one building. Employs trickling filter or other processes. Simple, efficient, economical, odor-free. Over 250 larger plants successfully operating in Europe.

Activated Sludge Plants also available.

Industrial Waste Treatment Plants.



LICENSEES WANTED FOR FABRICATING CONCRETE BLOCKS AND COMPONENTS

For descriptive folder and specifications, address:

American Schreiber Company

P. O. Box 482 • York, Pa.

ENTERPRISE

– the engine with the low noise level

ENTERPRISE *Diesels*

THE DEPENDABLE

Enterprise Engine & Machinery Co.
Subsidiary of General Metals Corporation, 18th & Florida Streets, San Francisco 10, Calif. • National and worldwide sales and service.

MEMO

If there's a problem
There's a solution;
If you have a problem
You might find the solution here

343

Pumps, Sludge—Bulletin 191—Describes in full the capacities, heads, horsepowers, and dimensions of this screw conveyor, positive displacement "Scru-Flo" Sludge Pump.—Chicago Pump.

344

Phase Converters—Bulletins #123 and 305 describe design features and advantages of the patented autotransformer phase converter which permits three phase electric motors to be operated from single phase lines in pumping and sewer lift stations. Special packaged units incorporating pre-wired motor controls are available for sewer lift stations.—System Analyzer Corp.

345

Valves, Water Works—Bulletin No. WW-58 gives complete information on many types of curb stops, corporation stops, gooseneck meter stops, service boxes and couplings that are popular in the water works industry.—A. Y. McDonald Mfg. Co.

346

Pipe, Cast Iron Pressure—Facilities brochure describing cast iron pressure pipe in 20′ lengths for water and gas. Brochure describes area serviced, selection of pipe joints available, layout of the plant and method of manufacture.—Griffin Pipe Div.

347

Supervisory Remote Control—The Bulletin SC outlines the method of pump or valve control over one pair of wires any distance. It also contains information on report back using the same pair of wires.—Healy-Ruff Company.

348

Filters—General information on Roberts filters for municipal water purification industrial water rectification, swimming pool recirculating systems and pressure filters.—Roberts Filter Mfg. Co.

349

Vitrified Clay Pipe—Bulletin PS-101 is a 4-page folder in color which describes Presto-Seal, a vastly improved vitrified clay pipe with patented spigots and sockets of air-cured polyester resin with a flexible rubber compression seal. Kaul Clay Company.

350

Valves, Cut-in—A 4-page bulletin tells how these cushioned emergency cut-in valves automatically open to emergency water supply.—Golden-Anderson Valve Specialty Co.

351

Packaged Pump Stations—Illustrated bulletin PS-60R provides the specifications and operating features of the duplex pump stations. On-the-job photographs show installation details.—Tex-Vit Supply Co.

352

Air Compressors, Self-Propelled—Catalog 5945 describes self-propelled air compressor furnishing 125 or 250 cfm at 100 psi. Easy mobility of these units plus ability to mount accessories makes them especially adaptable for both operational and maintenance applications.—Schramm, Inc.

353

Softeners—Bulletin 5763-A covers zeolite softeners built by General Filter Co. Included are facts on hardness, design, and construction notes, charts and method for selecting softeners. Various types of piping, valving and control are described.—General Filter Co.

354

Water Clarification—Hagan Coagulant Aids Nos. 7, 11 and 18, used to improve floc formation in clarifying and softening municipal, industrial and oil field water systems, are described.—Hagan Chemical & Controls, Inc.

355

New Plug Valve—Folder describes the new ORISEAL Valve. This maintenance free valve is permanently lubricated and is easy turning in large sizes even after long periods of use.—Mueller Co.

356

Water Storage Tanks—Bulletin T-22, 4-page booklet provides general information on prestressed concrete water storage tanks. T-19, and 8-page technical booklet on the design of prestressed concrete tanks for water supply—The Preload Co., Inc.

For further information on products or services please use reader service card.

357

Recorder-Totalizer—a 4 page bulletin describing the proper and efficient applications of recorder-totalizers—Standard Instrument Corp.

358

Coating, Protective—A 4-page bulletin on Rexon coating no. 2 for protecting concrete pipe inside and out, from corrosive attack.—Hamilton Kent Mfg. Co.

359

Tyton Joint® Pipe—This booklet presents the U.S. centrifugally cast iron TYTON JOINT pipe for water and sewage. This new joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly.—U.S. Pipe & Foundry Co.

360

Modern Sewage Treatment—Bulletin 6041 describes the distinguishing characteristics, types, sizes, applications and operation of major Dorr-Oliver sewage treatment equipment and presents a number of typical plant flow-sheets. Also included are photographs and line and wash drawings of various units.—Dorr-Oliver Inc.

361

Water Storage Tanks, Steel—"Steel Tanks Store Water Best" is an attractive, 8-page brochure containing many excellent photographs of a variety of different types of elevated tanks, standpipes and reservoirs constructed of steel in various parts of the country.—Steel Plate Fabricators Association.

362

Clarifiers—This bulletin 35-D describes two settling type clarifiers for both circular and rectangular tanks, equipped with both skimming and sludge scraping mechanisms.—Hardinge Company, Incorporated.

363

Valves, Knife Gate—Bulletin #200 illustrates various styles, materials, operators, and accessories of knife gate valves. Explains application for slurries, dry solids, crystalline and caking sludges. Features hand wheel, lever, pneumatic, hydraulic, actuation; on-off or positioning operators.—DeZurik Corp.

364

Clay Pipe—This 48-page fully illustrated brochure entitled "The Story of Clay Pipe" contains an historical record of clay pipe, its contribution to America from the beginning of the 20th century to the present, and a look into the future of American homes, industries, and communities.—National Clay Pipe Mfrs., Inc.

365

Pumps, Non-Clog, Sewage—Bulletin No. 500 contains detailed cross section drawing and information on vertical, close-coupled, "Non-Clog" sewage-pump for factory-built sewage pump stations.—Smith & Loveless Div.—Union Tank Car Company.

Consulting Engineers *IN WATER & SEWAGE WORKS*

ALBRIGHT & FRIEL INC.
Consulting Engineers
Water, Sewage, Industrial Wastes and Incineration Problems—City Planning, Highways, Bridges and Airports—Dams, Flood Control, Industrial Buildings—Investigations, Reports, Appraisals and Rates—Laboratory for Chemical & Bacteriological Analyses—Complete Service on Design and Supervision of Construction.
Three Penn Center Plaza
Philadelphia 2, Pa.

Bowe, Albertson & Associates
Engineers
Water and Sewage Works
Industrial Wastes
Refuse Disposal
Valuations
Laboratory Service
75 West St., New York 6, N.Y.
1000 Farmington Ave., West Hartford 7, Conn.

Capitol Engineering Corporation
Consulting Civil Engineers
Dillsburg, Pennsylvania, U.S.A.

Alvord, Burdick & Howson
Engineers
Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation
20 N. Wacker Drive, Chicago 6, Ill.

BOYLE ENGINEERING
Consulting Engineers
Water—Sewers—Streets
Structures—Surveys
Reports—Special Districts
331 Spurgeon Bldg., Santa Ana, Calif.
3913 Ohio, Rm. 200, San Diego 4, Calif.

The Chester Engineers
Water Supply and Purification—Sewage and Industrial Waste Treatment—Power Plants—Incineration—Gas Systems—Valuations—Rates—Management—Laboratory—City Planning
501 Sulsman Street
Pittsburgh 12, Penna.

JOHN J. BAFFA
Consulting Engineer
Water Supply and Treatment
Sewerage and Sewage Treatment
75 West Street, New York 6, N. Y.

Brockway, Weber & Brockway Engineers
INCORPORATED
George S. Brockway, George R. Brockway, Roy E. Weber
STAFF
H. L. Fitzgerald, Robert E. Owen, Thomas A. Clark, Charles A. Anderson, Ben E. Whittington, Ernest L. Greene, Thomas R. Demery, Tom G. Lively
Civil, Structural, Sanitary, Municipal, Electrical, Land Planning
West Palm Beach, Florida, Ft. Pierce, Florida

CHAS W. COLE & SON
Engineers and Architects
3600 E. Jefferson Blvd.
South Bend, Indiana
2112 W. Jefferson St.
Joliet, Illinois

MICHAEL BAKER, JR., INC.
The Baker Engineers
Civil Engineers, Planners, and Surveyors
Airports, Highways, Sewage Disposal Systems, Water Works Design and Operation—City Planning—Municipal Engineering—All types of Surveys
Home Office: Rochester, Pa.
Branch Offices:
Jackson, Miss., Harrisburg, Pa.

Buck, Seifert and Jost
Consulting Engineers
Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories
112 East 19th St., New York

CONSOER, TOWNSEND & ASSOCIATES
—CONSULTING ENGINEERS—
Sewage treatment, sewers, storm drainage, flood control—Water supply and treatment—Highway and bridges—Airports—Urban renewal—Electric and gas transmission lines—Rate studies, surveys and valuations—Industrial and institutional buildings.
360 East Grand Avenue, Chicago 11, Illinois

Betz Laboratories, Inc.
CONSULTING ENGINEERS
INDUSTRIAL WASTE
INDUSTRIAL WATER
ANALYSIS, DESIGN
INVESTIGATIONS, OPERATION
Gillingham & Worth Sts.
Philadelphia 24, Pa.

BURGESS & NIPLE
Civil and Sanitary Engineers
Water Supply and Purification
Sewerage and Sewage Treatment
Appraisals, Reports, Valuations
2015 West Fifth Avenue
Columbus 12, Ohio

MR. CONSULTING ENGINEER
Are you interested in both
WATER & SEWAGE
If so there is no better place for your professional card than in this dual interest magazine.
Water & Sewage Works

BLACK & VEATCH
Consulting Engineers
Sewage—Waste Disposal—Water
Electricity—Industry
Reports, Design, Supervision of Construction, Investigations, Valuations and Rates
1500 Meadow Lake Parkway
Kansas City 14, Missouri

BURNS & McDONNELL
Engineers—Architects—Consultants
4600 E. 63rd St. Trafficway
Kansas City 41, Missouri

CRAWFORD, MURPHY & TILLY
Consulting Engineers
Water Works—Impounding Reservoirs
Highways—Municipal Streets—Expressways
Traffic Problems—Airports—Swimming Pools
Sewers—Sewage Treatment—Wastes Treatment
Storm Drainage—Flood Control—Surveys & Reports
LAKESIDE 8-5619
755 So. Grand Ave., W. SPRINGFIELD, ILL.

CLINTON BOGERT ENGINEERS
CONSULTANTS
Clinton L. Bogert, Donald M. Ditmars, Charles A. Manganaro, Ivan L. Bogert, Robert A. Lincoln, William Martin
Water & Sewage Works • Incinerators
Drainage • Flood Control
Highway and Bridges • Airfields
145 East 32nd Street, New York 16, N. Y.

Camp, Dresser & McKee
Consulting Engineers
18 Tremont Street, Boston 8, Mass.
Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

ROY B. EVERSON
Water Treatment Service Since 1900 for Swimming Pool Circulating Systems. Purification Systems as applied to Sewage Treatment and Water Works. A New System for Automatic Control.
233 W. Huron Street, Chicago 10, Ill.

Additional Engineers Cards on Next Page

ENGINEER ASSOCIATES
Consulting Engineers
Sewage Disposal Systems, Water Works Design, Airports, Highways and Bridges, City Planning & Engineering for Building Design
312 N. W. Eighth St.
Evansville, Indiana

FAY, SPOFFORD & THORNDIKE, INC.
Engineers
Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment
Airports — Bridges — Express Highways
Port and Terminal Works — Industrial Plants
Investigations, Reports, Designs, Valuations
Supervision of Construction
11 BEACON STREET, BOSTON 8, MASS.

FINKBEINER, PETTIS & STROUT
CONSULTING ENGINEERS
Water Supply, Water Treatment,
Sewerage, Sewage Treatment,
Bridges, Highways & Expressways
2130 Madison Avenue — Toledo 2, Ohio

FULTON & CRAMER
Consulting Engineers
General Municipal Engineering Service Since 1909
Reports
Valuations
Rate Studies
Design
Construction Supervision
922 *Trust Building — Lincoln, Nebraska*

GANNETT FLEMING CORDDRY & CARPENTER, Inc.
ENGINEERS
Dams, Water Works, Sewage, Industrial Wastes & Garbage Disposal, Highways, Bridges & Airports — Traffic & Parking Appraisals, Investigations & Reports
HARRISBURG, PA.
PITTSBURGH, PA. PHILADELPHIA, PA.
DAYTONA BEACH, FLA.

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service
Investigations and Reports
New York Reading, Pa. Washington
Houston Philadelphia

GREELEY AND HANSEN
Engineers
Samual A. Greeley Paul Hansen (1920-1944)
Paul E. Langdon Kenneth V. Hill
Thomas M. Niles Samual M. Clarke
Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal
14 East Jackson Blvd., Chicago 4

HASKINS, RIDDLE & SHARP
Consulting Engineers
Water—Sewage & Industrial Wastes—Hydraulics
Reports, Design, Supervision of Construction
Appraisals, Valuations, Rate Studies
1009 Baltimore Ave. Kansas City 5, Mo.

HAVENS AND EMERSON
A. A. BURGER H. H. MOSELEY
J. W. AVERY F. S. PALOCSAY
E. S. ORDWAY G. H. ASPLANALP
A. M. MOCK S. H. SUTTON
CONSULTING ENGINEERS
WATER, SEWERAGE, GARBAGE, INDUSTRIAL WASTES VALUATIONS—LABORATORIES
LEADER BLDG. CLEVELAND 14, O. WOOLWORTH BLDG. NEW YORK 7, N. Y.

HAZEN AND SAWYER
ENGINEERS
Richard Hazen Alfred W. Sawyer
H. E. Hudson, Jr.
Water and Sewage Works
Industrial Waste Disposal
Drainage and Flood Control
360 Lexington Ave., New York 17, N. Y.

Henningson, Durham & Richardson
Engineers • Architects • Planners • Consultants
ENGINEERING SINCE 1917
Reports, Planning, Appraisals, Architectural Design, Highways, Bridges, Streets, Airports, Sewerage, Waterworks, Power Plants, Electrical Systems, Natural Gas Systems, Industrial Design
OMAHA COLORADO SPRINGS PHOENIX

The Jennings-Lawrence Co.
Civil & Municipal Engineers
Consultants
Water Supply, Treatment & Distribution
Sewers & Sewage Treatment
Reports—Design—Construction
1392 King Ave. Columbus 12, Ohio

Jones, Henry & Williams
Consulting Sanitary Engineers
Water Works
Sewerage & Treatment
Waste Disposal
2000 West Central Ave. Toledo 6, Ohio

KENNEDY ENGINEERS
SANITARY ENGINEERING
LOS ANGELES—SALT LAKE CITY
TACOMA—SAN FRANCISCO

Morris Knowles, Inc.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal Valuations, Laboratory, City Planning
1312 Park Building, Pittsburgh, Pa.

LOZIER CONSULTANTS, INC.
Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal
Engineers
10 Gibbs Street Rochester 4, N. Y.

Metcalf & Eddy
Engineers
Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airports Valuations
Laboratory
Statler Building, Boston 16

O'BRIEN & GERE
Consulting Engineers
Water Supply, Treatment and Distribution
Sewerage and Sewage Treatment
Industrial Waste Treatment—Flood Control and Drainage—Rate Studies
400 East Genesee Street Syracuse 2, N. Y.

PARSONS, BRINCKERHOFF QUADE & DOUGLAS
Civil and Sanitary Engineers
Water, Sewage, Drainage and Industrial Waste Problems.
Structures—Power—Transportation
165 Broadway New York 6, N. Y.

MALCOLM PIRNIE ENGINEERS
Malcolm Pirnie Carl A. Arenander
Ernest W. Whitlock Malcolm Pirnie, Jr.
Robert D. Mitchell Alfred C. Leonard
MUNICIPAL AND INDUSTRIAL
Water Supply—Water Treatment
Sewage and Waste Treatment
Drainage—Rates—Refuse Disposal
25 West 43rd St. New York 36, N. Y.
3013 Horatio Street, Tampa 9, Florida

THE PITOMETER ASSOCIATES, INC.
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurements & Special Hydraulic Investigations
New York, 50 Church Street

LEE T. PURCELL
Consulting Engineers
Water Supply & Purification; Sewerage & Sewage Disposal; Industrial Wastes; Investigations & Reports; Design; Supervision of Construction & Operation
Analytical Laboratories
36 De Grasse Street Paterson 1, N. J.

Rader and Associates
Engineers and Architects
Water Works, Sewers, Refuse Disposal and Other Public Works Engineering Reports. Investigations, Consultations, Plans, Specifications and Supervision of Construction Work
100 Biscayne Blvd. South, Miami 32, Fla.

ROY EDWIN RAMSEIER AND ASSOCIATES
Sanitary and Hydraulic Engineers
Water Supply, Treatment, Distribution
Sewerage and Sewage Treatment
Chemical and Bacteriological Laboratories
1539 Solano Avenue, Berkeley 7, California

Additional Engineers Cards on Next Page

ROBERT AND COMPANY
ASSOCIATES
Engineering Division
ATLANTA

STANLEY ENGINEERING COMPANY
Consulting Engineers
Hershey Building — Muscatine, Iowa
208 S. LaSalle St. — Chicago 4, Ill.
Hanna Building — Cleveland 15, Ohio

Leonard S. Wegman Co.
Consulting Engineers
Refuse Disposal, Water Supply, Sewage Collection & Treatment, Highways, Bridges, Special Structures, Shore Erosion & Waterfront Works
235 East 45th Street New York 17, N. Y.

Thomas M. Riddick
Consulting Engineer and Chemist
Municipal and Industrial Water Purification Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.
369 East 149th Street
New York 55, N. Y.

Alden E. Stilson & Associates
Limited
Consulting Engineers
Water Supply—Sewage—Waste Disposal
Bridges—Highways—Industrial Buildings
Studies—Surveys—Reports
75 Public Square, Cleveland 13, Ohio
245 North High Street, Columbus 15, Ohio

Weston & Sampson
Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service Supervision, Valuations
14 Beacon St. — Boston, Mass.

Benjamin L. Smith & Associates
Engineers
Investigations—Reports
Designs—Supervision—Valuations
Municipal Engineering and Public Utilities
11 North Pearl Street
Albany 7, New York

SWINDELL-DRESSLER CORP.
Consulting Engineers
Industrial Plants—Waterworks
Sewer Systems—Highways—Dams
Bridges—Surveys—Reports
Design and Construction Supervision
Box 1888 • Pittsburgh 30, Pa.

Whitman & Howard
Engineers (Est. 1869)
Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.
89 Broad St., Boston, Mass.

John R. Snell
ENGINEERS
Inc. 221 N. Cedar ■ Lansing, Mich. ■ IV 4-9493
Water Purification ■ Water Supply ■ Sewerage Systems ■ Sewage Treatment ■ Refuse Collection ■ Composting ■ Incineration ■ Urban Planning ■ Industrial Waste ■ Bridges and Streets ■ Soils and Foundations ■ Research and Development

Turner & Collie
Consulting Engineers, Inc.
2111 C & I Life Building
Houston 2, Texas

WHITMAN, REQUARDT & ASSOCIATES
Engineers—Consultants
Civil—Sanitary—Structural—Mechanical—Electrical
Reports, Plans, Supervision, Appraisals
1304 St. Paul Street
Baltimore 2, Maryland

FOR **fun** IN **FLORIDA**

DOCTORS Motel

Luxurious rooms with patios and balconies, free TV, radio, Hi-Fi in all rooms. Phones. Heated pool, boating, water ski lessons, fishing, golf, private beach. Restaurant and cocktail lounge on the premises. Everything for a perfect vacation. Credit cards honored.

6800 34th St., So.—U. S. 19
ST. PETERSBURG

FREE!
Write for literature and new TRAVEL GUIDE listing fine motels from coast to coast, inspected and approved by Congress of Motor Hotels.

NEW YORK CITY
for important business and leisurely pleasure

TIMES SQUARE
for 'round-the-clock entertainment and city-wide convenience

HOTEL WOODSTOCK
ALBERT FERNANDEZ, General Manager
for top-flight accommodations & service—Cocktail Lounge & Restaurant

127 WEST 43 ST.
for full color brochure and full rate information

JUDSON 2-5000
for immediate confirmation of your Woodstock reservation

Re-new your structures with GUNITE!

★ durability

★ economy

★ flexibility

- DAMS
- RESERVOIRS
- TUNNELS
- GRAIN ELEVATORS
- BREAKWATERS
- CONCRETE TANKS
- FILTER PLANTS
- STADIUMS
- SEA WALLS
- PIPE LINES
- SEWERS
- STACKS
- BRIDGES

estimates, specifications and surveys made free of cost to you. write, wire or call MElrose 4-8120

INDIANA GUNITE & CONSTRUCTION CO., Inc.

ENGINEERING—CONSTRUCTION

CONTRACTS TAKEN ANYWHERE

Box 600 • Florence, Ala.

INDIANA GUNITE & CONSTRUCTION CO., INC.
1734 Villa Ave. • Indianapolis, Ind.
Gentlemen: Please have a representative contact me. I am interested in:
Description:.....
.....
.....
NAME.....
STREET.....
CITY.....STATE.....

Advertisers Index

A

*Allis Chalmers 11A-22A-23A
*American Cast Iron Pipe Co. 2A
American Schreiber Co. 107A

B

Badger Meter Mfg. Co. 14A-15A
*B-I-F Industries, Inc. 20A
*Builders Providence, Inc. 20A

C

Capitol Controls Co., Inc. 93A
Cast Iron Pipe Research Ass'n. 18A-19
*Chain Belt Co. 35A
*Chicago Bridge & Iron Co. 24A-25A
*Chicago Pump Co. 1A
*Climax Eng. Mfg. Co. (Div. Waukesha) 41A
*Clow & Sons, Jas. B. 8A-9A
Consulting Engineers 109A-110A-111A

D

Darling Valve & Mfg. Co. 95A
Dean & Co., Payne 99A
*DeZurik Corporation 28A

E

Eddy Valve Co. 38A
Enterprise Eng. & Machy. Co. 102A-105A-106A-107A

F

Fairbanks-Morse & Co., Diesel Div. 17A
Fischer & Porter Co. 31A
Ford Meter Box Co., Inc. 96A

G

Griffin Pipe Div., Griffin Wheel Co. 16A

H

*Hamilton-Kent Mfg. Co. 33A
Healy-Ruff Company 103A
Hersey Sparling Meter Co. 34A-36A
Hooker Chemical Corp. 90A

I

Indiana Gunite & Constr. Co., Inc. 112A
Industrial Chemical Sales Div. West Va. Pulp & Paper Co. 29A
Infilco Inc. ..... Back Cover

J

Johns-Manville 30A

K

*Komline-Sanderson Engr. Corp. 103A

L

Layne & Bowler ..... Inside Front Cover
LimiTorque Corporation 91A
Leopold Co. Inc., F. B. 21A
*Link-Belt Co. 27A

M

*M & H Valve & Fittings Co. 94A
Mortel Co. 102A
*Mueller Company ..... Inside Back Cover-13A
*Multiplex Mfg. Co. 100A

N

National Clay Pipe Mfrs'. Ass'n. 100A
*Neptune Meter Company 44A
*Nichols Engr. & Research Corp. 97A

O

Olin Mathieson Chem. Corp. 32A

P

*Pacific Flush Tank Company 37A
Pacific Pumping Co. 101A
Pfaudler-Permutit, Inc. 39A
Phelps Dodge Ref. Corp. 98A
Philadelphia Gear Corp. 91A
*Phipps Bird, Inc. 104A
*Pratt Co., Henry 26A
Price Bros. 87A

R

*Roberts Filter Co. 104A

S

*Smith-Loveless Inc. 89A
*Smith Mfg. Co., A. P. 42A
Synchro-Start Products, Inc. 105A

T

*Tennessee Corp. 4A

W

Walker Process Equip. Inc. 43A
Wood Co., R. D. 40A

*Advertisers represented in the 1960 Reference Number with Catalog specifications copy. Please refer to that issue for additional information concerning their product or equipment.

USE THIS **POST PAID** CARD
TO ENTER NEW SUBSCRIPTIONS

for

WATER & SEWAGE WORKS

. . . the leading monthly publication in its field for Superintendents, Operators and Engineers.

and

INDUSTRIAL WATER AND WASTES

. . . The ONLY publication devoted exclusively (and thoroughly) to the treatment of water for industrial uses AND the treatment, utilization and disposal of industrial wastes. Bi-monthly.

(see other side)

USE THIS **POST PAID** CARD
FOR READER SERVICE REQUESTS

The numbers on the card correspond to the numbers assigned to the various catalogs and other literature described in the "New Equipment" and "New Bulletin" sections of this issue, which are available FREE OF CHARGE.

Simply detach the card along the perforated lines, circle the items you wish to receive, fill in your name, address etc. and mail this card for our prompt attention.

(see other side)

PLEASE ENTER MY SUBSCRIPTION(S) AS INDICATED

☐ **WATER & SEWAGE WORKS, including the BIG Annual Reference Number, for.....year(s).**

Three Years—$10.00 Two Years—$7.50 One Year—$5.00

(Add $1.50 per year for countries other than the U. S. A. and Canada)

Please check your principal activity:

☐ **Sewage Only** ☐ **Water Only** ☐ **Water and Sewage**

☐ **INDUSTRIAL WATER AND WASTES, including the Annual Technical Review. One Year—$3.00.**

(Add $1.50 per year for countries other than the U. S. A. and Canada)

Please state products manufactured or processed, etc.:

Name .....

Title or Position .....

Department or Firm Name .....

Address .....

City ..... **Zn** ..... **State** .....

READER SERVICE CARD

MARCH 1961

Circle the items on which information is desired. Requests will be received until May 31, 1961.

301	302	303	304	305	306	307	308	309	310
311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340
341	342	343	344	345	346	347	348	349	350
351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370
371	372	373	374	375	376	377	378	379	380
381	382	383	384	385	386	387	388	389	390
391	392	393	394	395	396	397	398	399	

If You Wish to Receive Further Information on Products Advertised or Referred to in the Articles of This Issue—List the Page and Item Below.

.....

.....

.....

Your Name .....

Title .....

Company or Dept. .....

Address .....

.....

USE THIS **POST PAID** CARD
TO ENTER NEW SUBSCRIPTIONS

for

WATER & SEWAGE WORKS

. . . the leading monthly publication in its field for Superintendents, Operators and Engineers.

and

INDUSTRIAL WATER AND WASTES

. . . The ONLY publication devoted exclusively (and thoroughly) to the treatment of water for industrial uses AND the treatment, utilization and disposal of industrial wastes. Bi-monthly.

(see other side)

USE THIS **POST PAID** CARD
FOR READER SERVICE REQUESTS

The numbers on the card correspond to the numbers assigned to the various catalogs and other literature described in the "New Equipment" and "New Bulletin" sections of this issue, which are available FREE OF CHARGE.

Simply detach the card along the perforated lines, circle the items you wish to receive, fill in your name, address etc. and mail this card for our prompt attention.

(see other side)

Postage Will Be Paid by Addressee

BUSINESS REPLY MAIL
First Class Permit No. 43608, Sec. 34.9, P.L.&R., Chicago, Ill.

WATER & SEWAGE WORKS
185 NORTH WABASH AVENUE
CHICAGO 1, ILLINOIS

No Postage Stamp Necessary If Mailed in the United States

Postage Will Be Paid by Addressee

BUSINESS REPLY MAIL
First Class Permit No. 43608, Sec. 34.9, P.L.&R., Chicago, Ill.

WATER & SEWAGE WORKS
185 NORTH WABASH AVENUE
CHICAGO 1, ILLINOIS

No Postage Stamp Necessary If Mailed in the United States

repair hydrant traffic damage FAST

...without loss of water...without water shut-off...without digging

The Mueller AWWA Improved Fire Hydrant is quickly put back into action when knocked over.

Mueller's Safety Flange design prevents breakage of the hydrant barrel and bent or broken operating stem. Hydrant safety mechanism snaps off cleanly just above the ground line.

The compression-type main valve stays closed. No water is lost to affect pressure at neighboring hydrants. No damage is caused by flowing water. Lower stem section is held solidly in place to permit easy repair without digging.

The simple, inexpensive repair kit shown below contains all parts needed to completely restore hydrant to service in a matter of minutes.

Safety Flange Repair Kit

Consists of safety flange, safety stem coupling, safety flange gasket and can of Mueller hydrant lubricating oil.

Write for complete information and specifications.

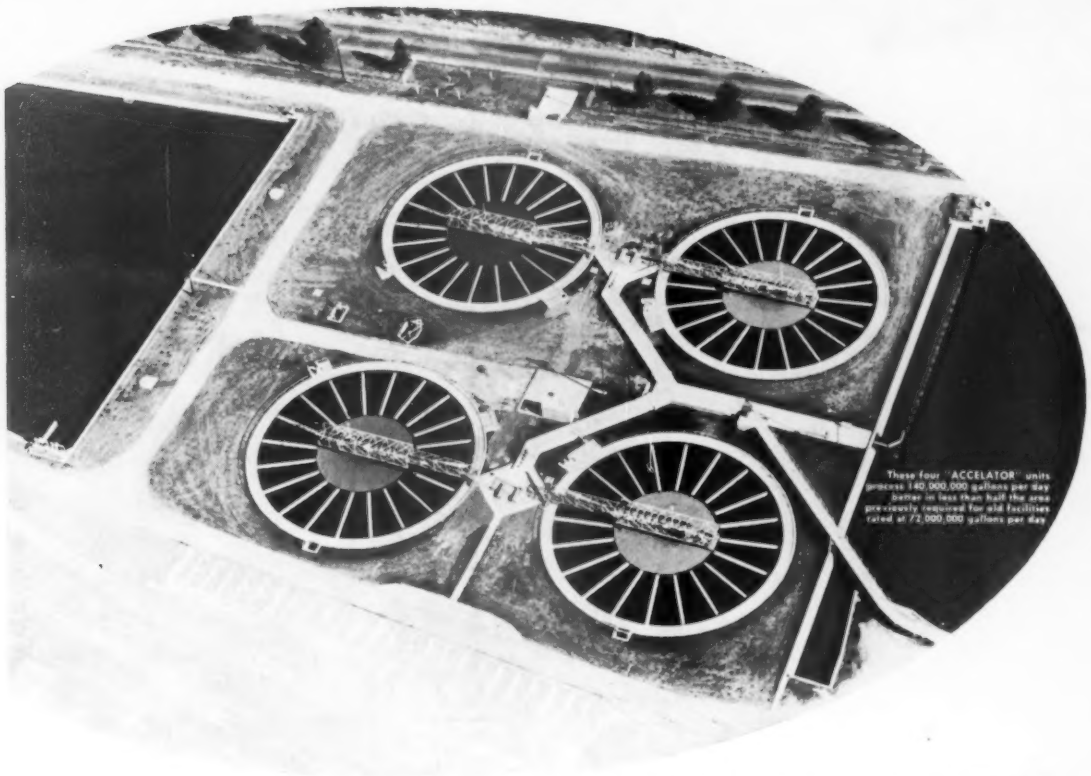
MUELLER CO. Since 1857 QUALITY SERVICE Watercraftsmanship

MUELLER CO.

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

4383


These four "ACCELATOR" units process 140,000,000 gallons per day better in less than half the area previously required for old facilities rated at 72,000,000 gallons per day

OMAHA SELECTED INFILCO EQUIPMENT *for* WORLD'S LARGEST High-rate Water Treating Plant

...saves hundreds of thousands...doubles production in half the space with latest ACCELATOR® clarifying units

Consulting Engineers:
BURNS & McDONNELL ENGINEERING CO.
Kansas City, Mo.

Another major city has installed ACCELATOR® units. This high rate treating plant is the largest of its kind in the world, with a maximum rated capacity of 140,000,000 gallons per day.

The Metropolitan Utilities District of Omaha and their Consulting Engineers, Burns & McDonnell, selected solids-contact units for the treatment of Missouri River water because they provided the greatest capacity in the limited space which was available. Extensive studies and evaluation of competitive bids received proved that "ACCELATOR" units were the best answer.

Each "ACCELATOR" basin is 120′ in diameter by 27′6″ deep. Each unit is guaranteed to produce a high quality effluent at minimum chemical cost, and to have a capacity of 35 m.g.d. with water temperature above 65° F. or 20 m.g.d. with water temperature below 35° F.

Performance tests have demonstrated that each "Accelator" unit will clarify 41 m.g.d. with water above 65° F. and at least 31 m.g.d. with 35° F. water—using even less chemicals than were indicated in laboratory jar tests; and produced effluent turbidities substantially less than 10 ppm. Subsequent operations under hardness reduction conditions has produced even better results.

This is typical of the results being obtained in more than 2500 "ACCELATOR" treating plants, treating every type of water for municipal and industrial use.

Write today for copy of Bulletin 1825-D.

Inquiries also invited on coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

INFILCO

INFILCO Inc.
General offices—Tucson, Arizona
Field offices throughout the United States and other countries

Eminence in design for water, sewage and waste treating and processing equipment...since 1894